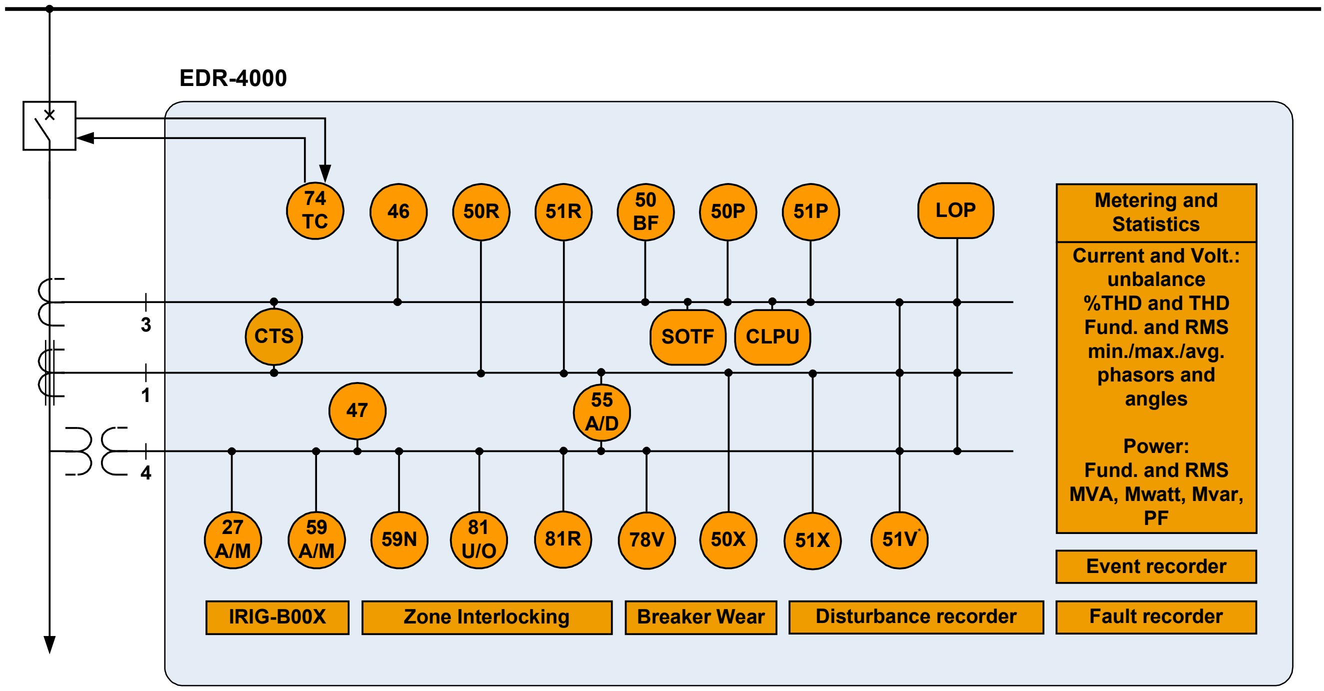
IM02602006E
Rev. New

EDR-4000 EATON DISTRIBUTION RELAY

Instruction manual for installing, operating and maintaining the EDR-4000



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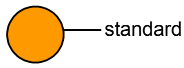

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This manual applies to devices (version):

Version 1.0.b

Build: 10085

Key Features, Functions and Benefits

- Microprocessor-based protection with monitoring and control for medium voltage main and feeder applications.
- Current, voltage, and frequency protection for electrical power distribution systems.
- Complete metering of voltage, currents, power, energy, minimum/maximum and demand* functions.
- Complete metering, protection, and control in a single compact case to reduce panel space, wiring and costs.
- Integral test function reduces maintenance time and expense.
- Zone selective interlocking improves coordination and tripping time, and saves money compared to a traditional bus differential scheme.
- Programmable logic control functions for main-tie-main transfer schemes*.
- Reduce trouble shooting time and maintenance costs- Trip and event recording in non-volatile memory provides detailed information for analysis and system restoration. 6000 cycles of waveform capture aids in post fault analysis (viewable using Powerport-E software)
- Minimum replacement time- Removable terminal blocks ideal in industrial environments
- Front RS-232 port and Powerport-E software provides local computer access and user-friendly windows based interface for relay settings, configuration, and data retrieval.
- Breaker open/close from relay faceplate* or remotely via communications.
- Fast an easy troubleshooting, improved maintenance procedures and increased device security. Provides detailed traceability for system configuration changes
- Relays self-diagnostics and reporting improves uptime and troubleshooting.
- Breaker trip circuit monitoring improves the reliability of the breaker operation.

*=future

General Description

Eaton's EDR-4000 distribution protection relay is a multi-functional, microprocessor-based relay for feeder circuits of all voltage levels. It may be used as the primary protection on feeders, mains and tie circuit breaker applications; or as backup protection for transformers, high voltage lines and differential protection. The relay is most commonly used on medium voltage switchgear applications

The EDR-4000 feeder protection relay provides complete current, voltage, and frequency protection and metering in a single, compact case. The relay has four current inputs rated for either 5 amperes or 1 ampere and four voltage inputs. Three of the voltage inputs are to be connected to the 3-phase power voltage for voltage protection and for metering. They can be connected in wye-ground or open delta configuration. The fourth voltage is for independent single-phase undervoltage/overvoltage protection, or ground protection for an ungrounded system.

The maintenance mode password protected soft key, can be used for arc flash mitigation to change to an alternate settings group, set to have instantaneous elements only. The multiple setting groups can also be changed, via communications or a digital input.

An integral keypad and display is provided for direct user programming and retrieval of data without the need of a computer. 14 programmable LEDs provide quick indication of relay status.

A front port is provided for direct computer connection. An RS-485 communication port on the back is standard for local area networking using Modbus-RTU. An optional Ethernet port and protocols are available.

The EDR-4000 distribution protection relay includes programmable logic functions*. Logic gates and timers may be defined and arranged for customized applications. Programmable logic control functions make the EDR-4000 relay ideally suited for main-tie-main and main 1/main 2 transfer schemes. Flash memory is used for the programming and all settings are stored in nonvolatile memory. The relay allows for four preprogrammed setting groups which can be activated through software or contact input.

Flash memory is used for the programming and all settings are stored in nonvolatile memory. The relay allows for four preprogrammed setting groups which can be activated through software, the display or a contact input.

The EDR-4000 distribution protection relay has mass memory for data storage and a real-time clock with 1 ms time resolution. The relay will log 300 sequence of event records, 20 detailed trip logs, minimum/maximum values, load profiles, breaker wear information and oscillography data.

The EDR-4000 has eight programmable binary inputs, 2 normally opened and 8 Form C heavy duty outputs and one form C signal alarm relay. It can be powered from 19 Vdc to 300 Vdc or 40 Vac to 250 Vac auxiliary power.

Features

Protection Features

Phase overcurrent elements

- Three instantaneous elements with timers (50P[1], 50P[2], and 50P[3])
- Three inverse time overcurrent elements (51P[1], 51P[2], and 51P[3])
- 11 standard curves
- Instantaneous or time delay reset

Ground overcurrent elements

- Two instantaneous measured elements with timers (50X[1], and 50X[2])
- Two instantaneous calculated elements with timers (50R[1], and 50R[2])
- Two inverse time overcurrent measured elements (51X[1], and 51X[2])
- Two inverse time overcurrent calculated elements (51R[1], and 51R[2])
- 11 standard curves
- Instantaneous or time delay reset

Breaker failure (50BF)

Phase unbalance negative sequence overcurrent (46[1], 46[2])).

Phase voltage unbalance and sequence protection (47[1], 47[2]).

Main 3-phase under/overvoltage (27M[1], 27M[2], 59M[1], 59M[2])

Auxiliary single-phase under/overvoltage (27A[1], 27A[2], 59A[1], 59A[2])

Ground fault overvoltage relay (59N[1], 59N[2])

6 Frequency elements that can be assigned to: over frequency, under frequency, rate of change, or vector surge (81[1], 81[2], 81[3], 81[4], 81[5], 81[6])

Apparent and displacement power factor (55A[1], 55A[2], 55D[1], 55D[2]).

Zone interlocking for bus protection (87B).

Switch onto fault protection

Cold load pickup

Zone interlocking for bus protection (87B).

Metering Features

- Amperes: Positive, negative and zero sequence.
- Ampere demand.
- Volts: Positive, negative and zero sequence.
- Phase angles.
- Volt-amperes and VA demand.
- Watts and kW demand.
- kWh (forward, reverse, net).
- Vars and kvar demand.
- kvarh (lead, leg and net).
- Power factor.
- Frequency.
- % THD V and I.
- Magnitude THD V and I.
- Minimum/maximum recording.
- Trending (load profile over time)*

*=future

Monitoring Features

- Trip coil monitor
- Breaker wear primary and secondary (accumulated interrupted current).
- Oscillography (6000 cycles total).
- Fault data logs (up to 20 events).
- Sequence of events report (up to 300 events).
- Clock (1 ms time stamping).

Communication Features

- Local HMI.
- Password protected.
- Addressable.
- IRIG-B
- Local communication port.
- Remote communication port:
- RS-232
- RS-485
- Protocols:
- Modbus-RTU
- Modbus-TCP (Optional)
- Configuration software

Protection and Control Functions

The Eaton's EDR-4000 distribution protection relay has been designed for maximum user flexibility and simplicity. The base relay includes all the standard current and voltage protection and metering functions.

Overcurrent Protection

The EDR-4000 distribution protection relay provides complete 3-phase and ground overcurrent protection. There are 8 independent ground overcurrent elements. The ground elements "X" use the independently measured ground (or neutral) current from a separate current-sensing input. The ground elements "R" uses a calculated 3Io residual current obtained from the sum of the 3-phase currents. This calculated current could be used for either the neutral or ground current in a 3-phase, 4-wire system. Each of the phase and ground overcurrent elements can be selected to operate based on fundamental or RMS current.

Voltage Restrained Overcurrent

Voltage restraint reduces the overcurrent pickup level (51P[3]). This modification of the pickup overcurrent level is compared to the corresponding phase input voltage. The EDR-4000 uses the simple linear model below to determine the effective pickup value.

Inverse-Time Characteristics

There are 11 user-selectable inverse-time overcurrent curve characteristics.
The user can select from the ANSI, IEC or thermal curve families and can select instantaneous or time delay reset characteristics.

Breaker Failure

The EDR-4000 distribution protection relay includes a breaker failure (50BF, 62BF) function that can be initiated from either an internal or external trip signal. This is an independent element that can be used to operate a lockout relay or trip an upstream breaker. The timer must be longer than the breaker operating time and the protective function reset times.

Voltage Protection

The EDR-4000 distribution protection relay has four voltage-input circuits. There is a 3-phase set designated as Main Voltage (M) and a single-phase voltage circuit designated as Auxiliary Voltage (A). Both include undervoltage (27) and overvoltage (59) protection. The 3-phase voltage protection can be set to operate on a single-phase, 2 out of 3 phases, or all 3-phase logic. The Main VTs also provide phase voltage unbalance/reversal (47 negative sequence) protection. Each element has an independent threshold set point and adjustable time delay.

Ground Voltage Protection

In high impedance grounded systems, ground fault protection is provided by the detection of zero sequence voltage (3Vo) voltage in the neutral of the transformer by an overvoltage element (59N) connected to the secondary of the distribution grounding transformer, or in the secondary of a Wye- Broken Delta transformer used when the neutral is not accessible or in Delta system. In the EDR-4000 we can measure this zero sequence voltage through the 4th voltage input; the 59N element has to be desensitized for 3rd harmonic voltages that can be present in the system under normal operation.

Flexible Phase Rotation

The EDR-4000 distribution protection relay can be applied on either an A-B-C or A-C-B phase rotation. A user setting permits correct operation and indication of the actual system configuration.

Frequency Protection

The EDR-4000 relay provides 6 frequency elements than can be used to detect under/over frequency, rate of change, and a vector surge (decoupling of two systems) protection on the Main VT inputs. Each element has an independent threshold set point and adjustable time delay.

Maintenance Mode
The Maintenance Mode can improve safety by providing a simple and reliable method to reduce fault clearing time
and lower incident energy levels at energized panels. The Maintenance Mode allows the user to switch to more sensitive settings via a password protected soft key, communication or via a digital Input while maintenance work is being performed at an energized panel or device. The more sensitive settings provide greater security for maintenance personnel and helps reduce the possibility of injury.

Monitoring and Metering

Sequence of Events Records
The EDR-4000 protection relay records a maximum of 300 events associated with the relay. An event is classified as a change of state as detected by the relay. These include relay pickups, dropouts, trips, contact closure, alarms, setting changes and self-diagnostic failures. Each event is date and time stamped to a 1 ms resolution. The events are stored in a FIFO in chronological order.

Trip Log
The EDR-4000 protection relay will store a maximum of 20 trip records in a FIFO trip log. Each trip record will be date and time stamped to a 1 ms resolution. The trip log record will include information on the type of fault, protection elements that operated, fault location and currents and voltages at the time of the fault.

Waveform Capture
The EDR-4000 transfomer protection relay provides oscillography-recording capabilities. The relay will record all measured signals along with the binary signals of pickup, trip, logic and contact closures. The ETR-4000 relay can record up to 6000 cycles of data. The number of records is proportional to the size of each record; the maximum size per record is 600 cycles. The waveform capture is initiated by up to 8 different triggers; it can also be generated manually through the display or via communications.

Integral User Interface
The front panel user interface has a 128 x 64 pixel LCD display with background illumination for wide angle viewing in all light conditions. 17 programmable LEDs provide quick and easy visual display of power on, mode of operation, alarm and trip indication. Soft keys are provided for operation mode selection, scrolling through data and settings. In addition, the relay settings and test functions are password protected.

Programmable I/O

The EDR-4000 distribution protection relay provides heavy-duty, trip-rated, 2 normally open and 8 Form C contacts. Two isolated inputs can be used for monitoring the trip circuit. One Form C contact is dedicated to the relay failure alarm function and is operated in a normally energized (failsafe) mode. There are eight user-configurable discrete inputs that accept a wet contact and can operate through a wide range of power. Each input and output is user-programmable for maximum application flexibility.

Comments on the Manual

This manual gives a general explanation of the tasks of device planning, parameter setting, installation, commissioning, operation, and maintenance of the Eaton devices.

The manual serves as reference document for:

- Engineers in the protection field;
- Commissioning engineers;
- Personnel dealing with the setting, testing, and maintenance of protection and control devices; and
- Well trained personnel involved in electrical installations and power stations.

All functions concerning the type code will be defined. Should there be a description of any functions, parameters, or inputs/outputs that do not apply to the device in use, please ignore that information.

All details and references are explained to the best of our knowledge and are based on our experience and observations.

This manual describes the full featured versions of the devices, including all options.

All technical information and data included in this manual reflect their state at the time this document was issued. Eaton Corporation reserves the right to carry out technical modifications in line with further development without changing this manual and without previous notice. Therefore no claim can be brought based on the information and descriptions included in this manual.

Text, graphics, and formulas do not always apply to the actual delivery scope. The drawings and graphics are not true to scale. Eaton Corporation does not accept any liability for damage and operational failures caused by operating errors or disregarding the directions of this manual.

No part of this manual is allowed to be reproduced or passed on to others in any form, unless Eaton Corporation has issued advanced approval in writing.

This user manual is part of the delivery scope when purchasing the device. In case the device is passed on (sold) to a third party, the manual has to be passed on as well.

Any repair work carried out on the device requires skilled and competent personnel with verifiable knowledge and experienced with local safety regulations and have the necessary experience with working on electronic protection devices and power installations.

IMPORTANT DEFINITIONS

The symbol/word combinations detailed below are designed to call the User's attention to issues that could affect User safety and well being as well as the operating life of the device.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.

NOTICE

NOTICE is used to address information and practices not related to personal injury.

WARNING

FOLLOW INSTRUCTIONS

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow the instructions can cause personal injury and/or property damage.

WARNING

PROPER USE

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (1) constitute "misuse" and/or "negligence" within the meaning of the product warranty, thereby excluding warranty coverage for any resulting damage; and (2) invalidate product certifications or listings.

The programmable devices subject to this manual are designed for protection and also control of power installations and operational devices. The devices are further designed for installation in low voltage (LV) compartments of medium voltage (MV) switchgear panels or in de-centralized protection panels. The programming and settings have to meet all requirements of the protection concept (of the equipment that is to be protected). The User must ensure that the device will properly recognize and manage (e.g.: switch off the circuit breaker) on the basis of User selected programming and settings all operational conditions (failures). Before starting any operation and after any modification of the programming/settings, make a documented proof that the programming and settings meet the requirements of the protection concept.

Typical applications for this product family/device line are for example:

- **Feeder protection;**
- **Mains protection;**
- **Transformer Protection and**
- **Machine protection.**

This device is not designed for any usage beyond these applications. The manufacturer cannot be held liable for any resulting damage. The User alone bears the risk if this device is used for any application for which it was not designed. As to the appropriate use of the device: the technical data specified by Eaton Corporation has to be met.

WARNING

OUT-OF-DATE PUBLICATION

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the Eaton Corporation website:

www.eaton.com

The latest versions of most publications are available at this site.

If the User's publication is not found on the web site, please contact Eaton Customer Support to get the latest copy.

CAUTION

ELECTROSTATIC DISCHARGE AWARENESS

All electronic equipment is sensitive to electrostatic discharge, some components more than others. To protect these components from electrostatic damage, the User must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the device.

1. **Before performing maintenance on the electronic device, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).**

2. **Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.**

3. **Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the device, the modules, and the work area as much as possible.**

4. **Do not remove any printed circuit board (PCB) from the device cabinet unless absolutely necessary. If you must remove the PCB from the device cabinet, follow these precautions:**
   - **Do not touch any part of the PCB except the edges.**
   - **Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.**
   - **When replacing a PCB, keep the new PCB in the plastic, anti-static protective bag it comes in until you are ready to install the PCB. Immediately after removing the old PCB from the device cabinet, place it in the anti-static protective bag.**

Eaton Corporation reserves the right to update any portion of this publication at any time. Information provided by Eaton Corporation is believed to be correct and reliable. However, no responsibility is assumed by Eaton Corporation unless otherwise expressly undertaken.

What Is Included with the Device

The device package includes all connection terminals, except communication connectors, but does not include the fastening material. Please check the package for completeness upon delivery.

Device Package Contents:

- 1 – Protective Relay;
- 1 – Mount (Standard or Projection);
- 1 – Quick Start Guide; and
- 2 – CDs
  - Disk 1 - Contains the User's Manual, Modbus Datapoint List, Wiring Diagram, and Device Template for Off-line Parameter Setting;
  - Disk 2 - Contains PowerPort-E and Quality Manager software applications.

NOTICE **Disk1 contains the device templates. The device templates MUST BE installed to allow PowerPort-E to configure a device off-line.**

Please make sure the product label, wiring diagram, type code, and materials and description pertain to this device. If you have any doubts, please contact Eaton Corporation's Customer Service Department.

Storage

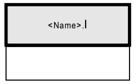
The devices must not be stored outdoors. If stored, it must be stored in an area with temperature and humidity control (see the Technical Data section contained in this manual).

Important Information

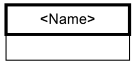
WARNING **In line with the customer's requirement, the devices are combined in a modular way (in compliance with the order code). The terminal assignment of the device can be found on the top of the device (wiring diagram). In addition, it can be found within the Appendix of this manual (see Wiring Diagrams).**

Symbols

Setting Value:



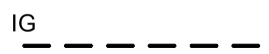
Device Planning:



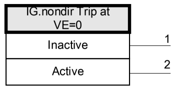
Signal:

Internal message

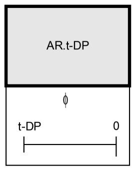
Measured Values:



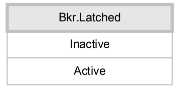
Functional description: If the setting value "IG.Block at VE=0" is set to "inactive", the output 1 is active and output 2 is inactive. If the setting value "IG.Block at VE=0" is set to "active", the output 2 is active and the output 1 is inactive.



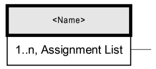
"ϕ"=Elements with complex functions "gray-box".



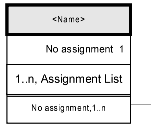
Option/features to be realised in the future.



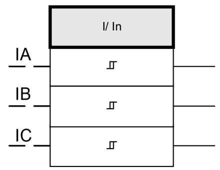
Parameter of a Module-Input with a SelectionList/DropDown. An (1..n) signal/output from the list or a pre-defined value can be selected.



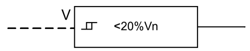
Parameter of a Module-Input (with special values): An (1..n) output from the list will be assigned to the input "<name>.identifier". If the parameter is set to "ItemNull", an "active"-signal will be given out.

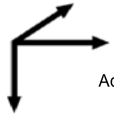


Limit value monitoring with three analog input values. Compares 3 analog values with the set limit; output values are three different binary values as a result of the comparision. If the analog signal exceeds the limit I/In, the corresponding output signal becomes "1".



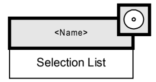
Limit value monitoring (Compared to a fixed value). Compares a value with the fixed set limit; output value is binary as a result of the comparision. If the signal exceeds the limit, the corresponding output signal becomes "1".

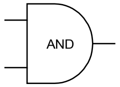
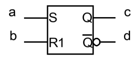
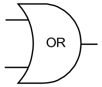
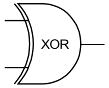
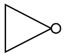
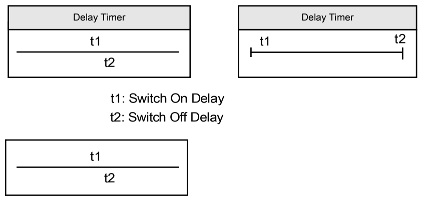
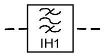
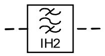
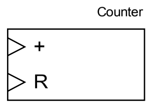
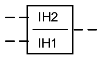
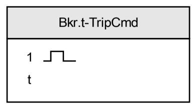


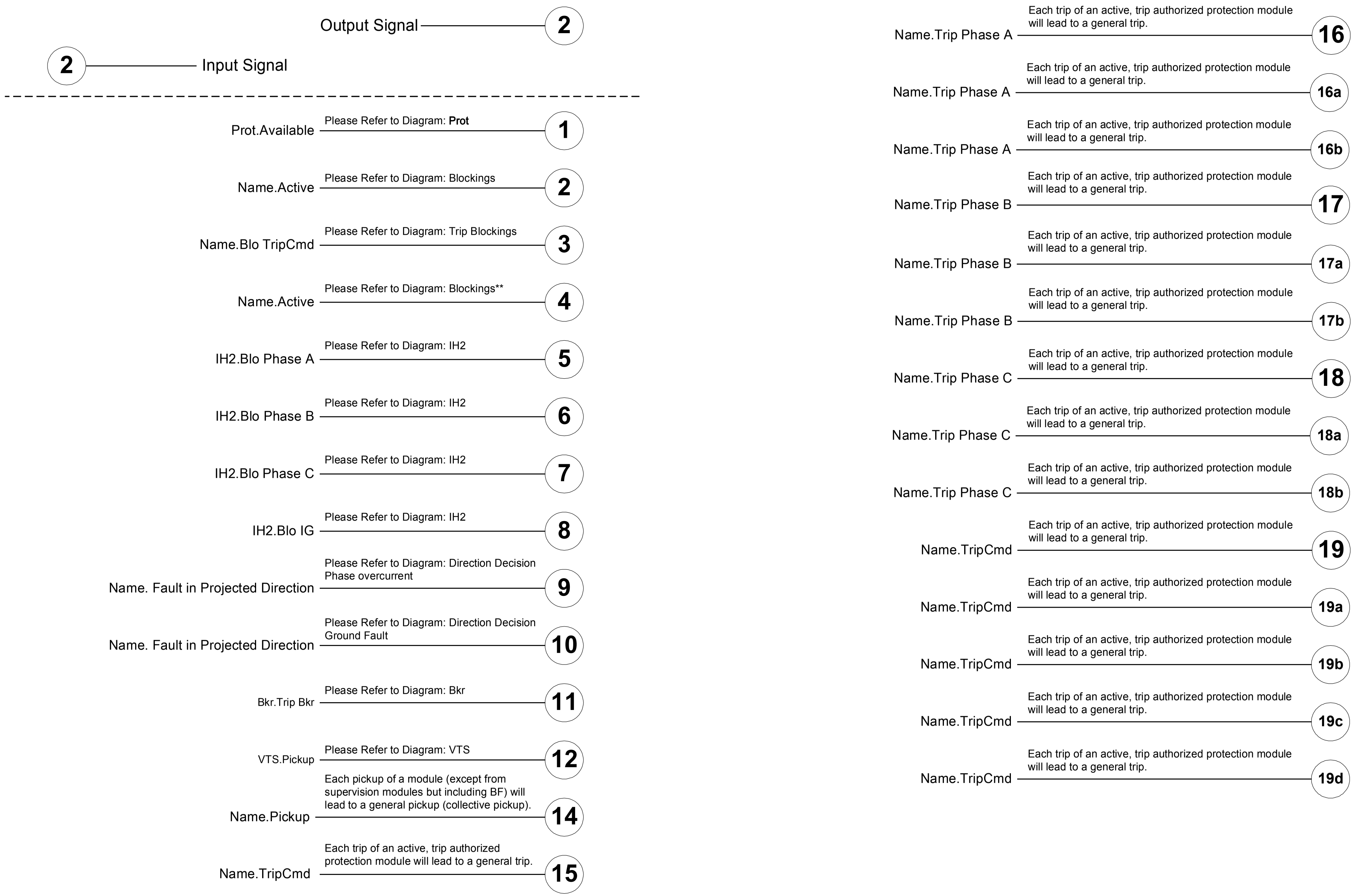


Adaptive Parameter

Direct Command



And		RS flip-flop a b | c d 0 0 | Unchanged 0 1 | 0 1 1 0 | 1 0 1 1 | 0 1	
Or			
Exclusive-XR			
Inverting		Time stage: A "1" at the input starts the element. If the time <name>.t is expired, the output becomes "1" too. The time stage will be reset by "0" at the input. Thus the output will be set to "0" at the same time.	
Negated Input			
Negated Output			
Band-pass (filter) IH1			
Band-pass (filter) IH2		Edge triggered counter + Increment R Reset	
Quotient of Analog Values		Time stage minimum pulse width: The pulse width <name>.t will be started if a "1" is feed to the input. By starting <name>.t, the output becomes "1". If the time is expired, the output becomes "0" independent from the input signal.	
Analog Values	- - - - - - - - - - - -		
Analog Value Comparator			


Output Signal 2
2 Input Signal
Prot.Available
Please Refer to Diagram: Prot
1
Name.Active
Please Refer to Diagram: Blockings
2
Name.Blo TripCmd
Please Refer to Diagram: Trip Blockings
3
Name.Active
Please Refer to Diagram: Blockings**
4
IH2.Blo Phase A
Please Refer to Diagram: IH2
5
IH2.Blo Phase B
Please Refer to Diagram: IH2
6
IH2.Blo Phase C
Please Refer to Diagram: IH2
7
IH2.Blo IG
Please Refer to Diagram: IH2
8
Name. Fault in Projected Direction
Please Refer to Diagram: Direction Decision Phase overcurrent
9
Name. Fault in Projected Direction
Please Refer to Diagram: Direction Decision Ground Fault
10
Bkr.Trip Bkr
Please Refer to Diagram: Bkr
11
VTS.Pickup
Please Refer to Diagram: VTS
12
Name.Pickup
Each pickup of a module (except from supervision modules but including BF) will lead to a general pickup (collective pickup).
14
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
15
Name.Trip Phase A
Each trip of an active, trip authorized protection module will lead to a general trip.
16
Name.Trip Phase A
Each trip of an active, trip authorized protection module will lead to a general trip.
16a
Name.Trip Phase A
Each trip of an active, trip authorized protection module will lead to a general trip.
16b
Name.Trip Phase B
Each trip of an active, trip authorized protection module will lead to a general trip.
17
Name.Trip Phase B
Each trip of an active, trip authorized protection module will lead to a general trip.
17a
Name.Trip Phase B
Each trip of an active, trip authorized protection module will lead to a general trip.
17b
Name.Trip Phase C
Each trip of an active, trip authorized protection module will lead to a general trip.
18
Name.Trip Phase C
Each trip of an active, trip authorized protection module will lead to a general trip.
18a
Name.Trip Phase C
Each trip of an active, trip authorized protection module will lead to a general trip.
18b
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19a
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19b
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19c
Name.TripCmd
Each trip of an active, trip authorized protection module will lead to a general trip.
19d

No.	Signal	Description
20	Name.Trip Phase A	Each trip of an active, trip authorized protection module will lead to a general trip.
21	Name.Trip Phase B	Each trip of an active, trip authorized protection module will lead to a general trip.
22	Name.Trip Phase C	Each trip of an active, trip authorized protection module will lead to a general trip.
23	Name.Trip	Each trip of an active, trip authorized protection module will lead to a general trip.
24	Name.Pickup IA	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
24a	Name.Pickup IA	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
24b	Name.Pickup IA	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
25	Name.Pickup IB	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
25a	Name.Pickup IB	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
25b	Name.Pickup IB	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
26	Name.Pickup IC	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
26a	Name.Pickup IC	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
26b	Name.Pickup IC	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
27	Name.Pickup	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
27a	Name.Pickup	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
27b	Name.Pickup	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
27c	Name.Pickup	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
27d	Name.Pickup	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
28	Name.Pickup Phase A	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
29	Name.Pickup Phase B	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
30	Name.Pickup Phase C	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
31	Name.Pickup	Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).
32	Prot.Blo TripCmd	
33	Bkr.State	Please Refer to Diagram: Bkr.Bkr Manager
34	Bkr.Pos CLOSE	Please Refer to Diagram: Bkr.Bkr Manager
35	Bkr.Pos OPEN	Please Refer to Diagram: Bkr.Bkr Manager
36	Bkr.Pos Indeterm	Please Refer to Diagram: Bkr.Bkr Manager
37	Bkr.Pos Disturb	Please Refer to Diagram: Bkr.Bkr Manager
38	LOP.LOP Blo	Please Refer to Diagram: LOP.LOP Blo

Genral Conventions

»*Parameters are indicated by right and left double arrow heads and written in italic.*«

»SIGNALS are indicated by right and left double arrow heads and small caps.«

[Pathes are indicated by brackets.]

Software and Devicenames are written in italic.

<u>*Modul and Instance (Element) names are displayed italic and underlined.*</u>

»Pushbuttons, Modes, and Menu entries are indicated by right and left double arrow heads.«

Device

EDR-4000

Device Planning

Planning of a device means to reduce the functional range to a degree that suits the protection task to be fulfilled (i.e.: the device shows only those functions needed or desired). If the User, for example, deactivates the voltage protection function, all parameter branches related to this function will not appear in the parameters. All corresponding events, signals, etc., will also be deactivated. Due to this change, the parameter trees become very transparent.

Planning also involves adjustment of all basic system data (frequency, etc.).

WARNING **It MUST be taken into account that by deactivating, for instance, the protective functions, the User also changes the functionality of the device. If the User cancels the directional feature of the overcurrent protections, then the device no longer trips in a directional way but merely in a non-directional way.**

The manufacturer does not accept liability for any personal or material damage as a result of incorrect planning.

Contact your Eaton Customer Service representative for more information.

WARNING **Beware of the inadvertent deactivating of protective functions/modules.**

If the User is deactivating modules within the device planning, all parameters of those modules will be set on default.

If the User is activating one of these modules, again, all parameters of those reactivated modules will be set on default.

NOTICE **If the protective device is equipped with Zone Interlocking, overcurrent and earth current elements are needed to trigger the Zone Interlocking function. Therefore, some overcurrent and earth current elements cannot be deactivated if the device is equipped with Zone Interlocking.**

Device Planning Parameters of the Device

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Hardware Variant 1	Optional Hardware Extension	»A« 8 DI, 2 Form A, 8+1 Form C, ZI	8 DI, 2 Form A, 8+1 Form C, ZI	[EDR-4000]
Hardware Variant 2	Optional Hardware Extension	»0« Without	»0« Without	[EDR-4000]
Communication	Communication	»B« Modbus RTU: RS485 / Terminals, »I« RS485 term / Ethernet	Modbus RTU: RS485 / Terminals	[EDR-4000]
Printed Circuit Board	Printed Circuit Board	»A« Standard, »B« Conformal Coating	»A« Standard	[EDR-4000]

There are two mounts available for the EDR-4000: a Standard Mount and a Projection Mount. To order the EDR-4000 with a Standard Mount, append the device code with a zero (0). To order the EDR-4000 with a Projection Mount, append the device code with a one (1). Refer to the table below for details of the available device options.

EDR-4000 Eaton Distribution Relay Removable Terminals					
EDR-4000	**A**	**0**	**B**	**A**	**1**
Choose from the following options.					
Hardware Option 1					
8 DI, 11 Outputs, Removable Terminals, Zone Interlocking.	A				
8 DI, 11 Outputs, Removable Terminals, Zone Interlocking, and Larger Display*.	B				
Hardware Option 2					
Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac.		0 (Zero)			
Phase Current 5A/1A, Sensitive Ground Current 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac.*		1			
Communication Options					
Modbus-RTU (RS-485)			B		
IEC-61850**			H		
Modbus-RTU + Modbus-TCP			I		
Conformal Coating Options					
None				A	
Conformal Coated Circuit Boards				B	
Mounting Options					
Standard Mount					0 (Zero)
Projection Panel Mount					1

* Consult factory for the availability of sensitive ground and larger display.
** Future Option.

The catalog number identification table defines the electrical characteristics and operation features included in the EDR-4000. For example, if the catalog number were EDR-4000A0BA1, the device would have the following:

EDR-4000

(A) - 8 DI, 11 Outputs, Removable Terminals, Zone Interlocking

(0) - Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac.

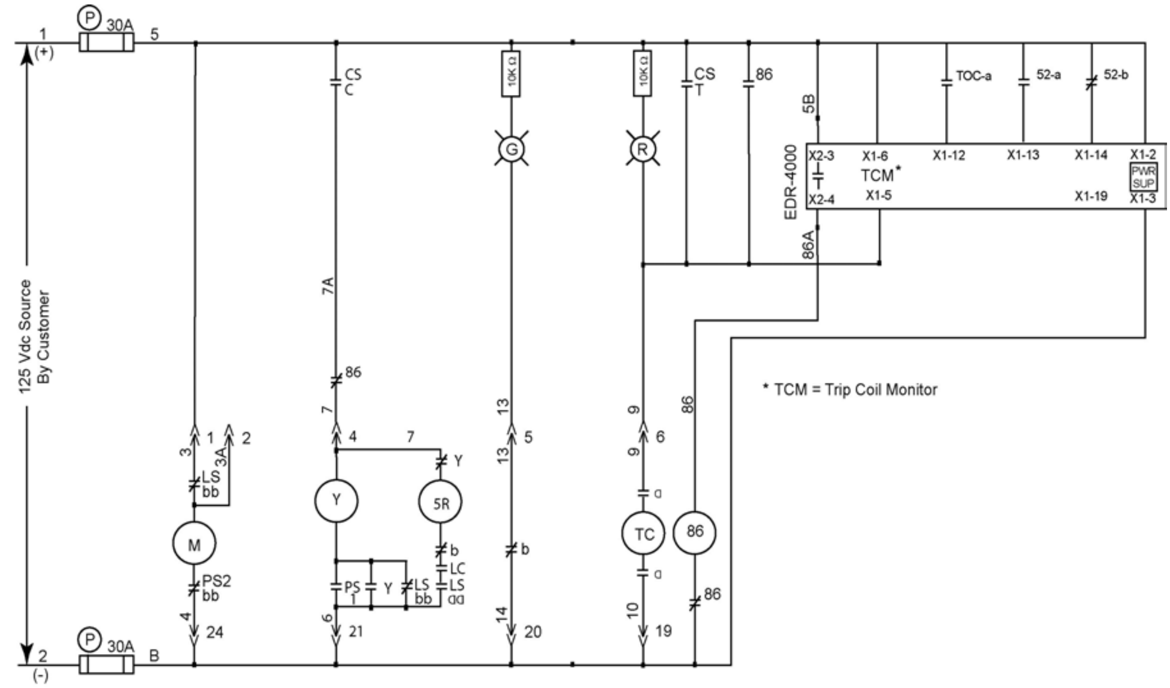
(B) - Modbus-RTU (RS-485)

(A) - Without Conformal Coating

(1) - Projection Panel Mount

Control Wiring Diagram

Below is the recommended control wiring schematic for the EDR-4000.



Schematic for Feeder Breaker (DEV 52)
Vertical Section No. 3B

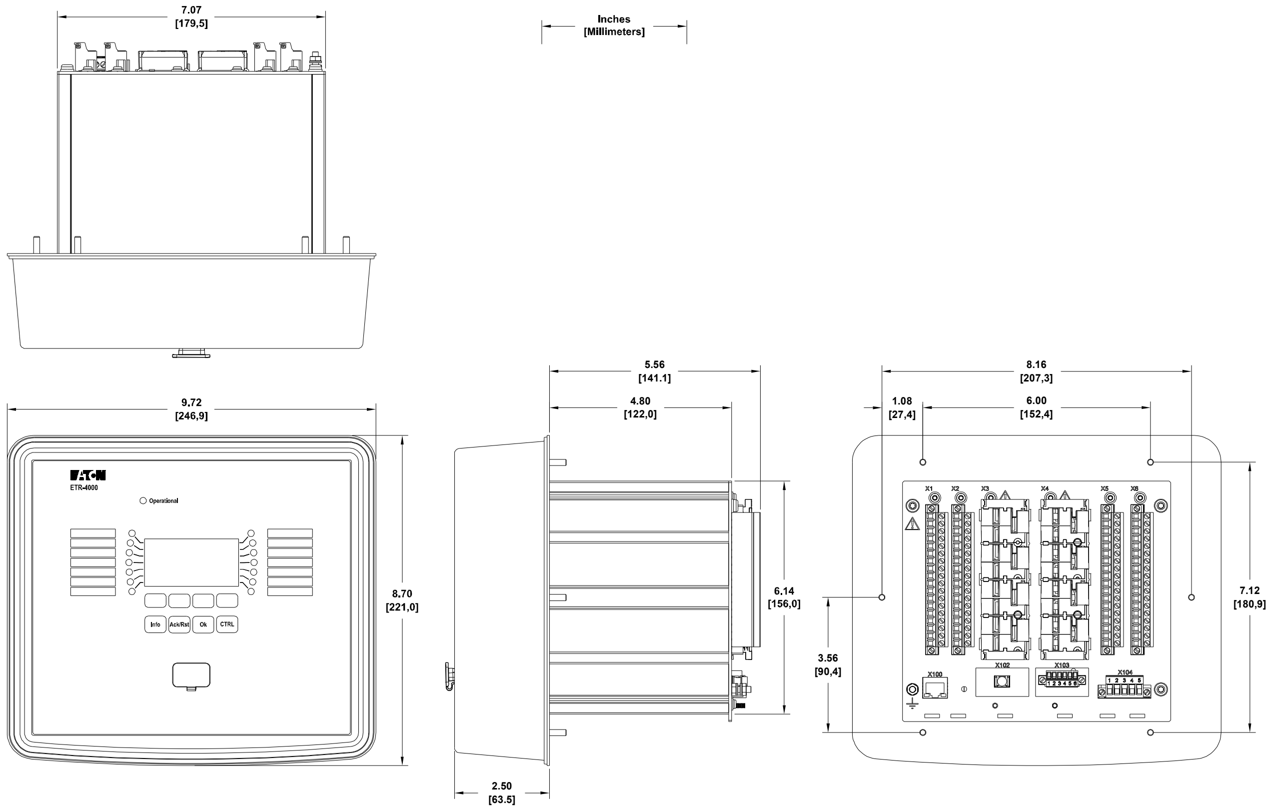
Wiring Diagrams

Please refer to the file "edr-4000_wiring_diagrams.pdf" on your manual CD.

Installation and Wiring

Three-Side-View

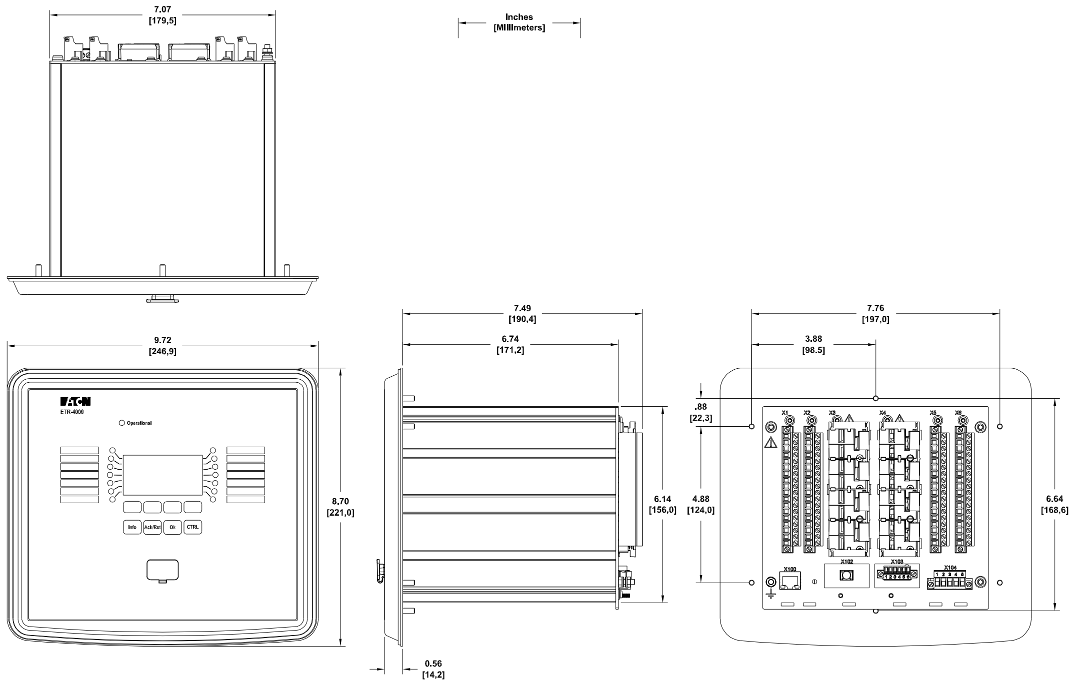
NOTICE **Depending on the connection method of the communication system used, the needed space (depth) differs. If, for instance, a D-Sub-Plug is used, it has to be added to the depth dimension.**



Outline Projection Mount

WARNING **The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).**

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.



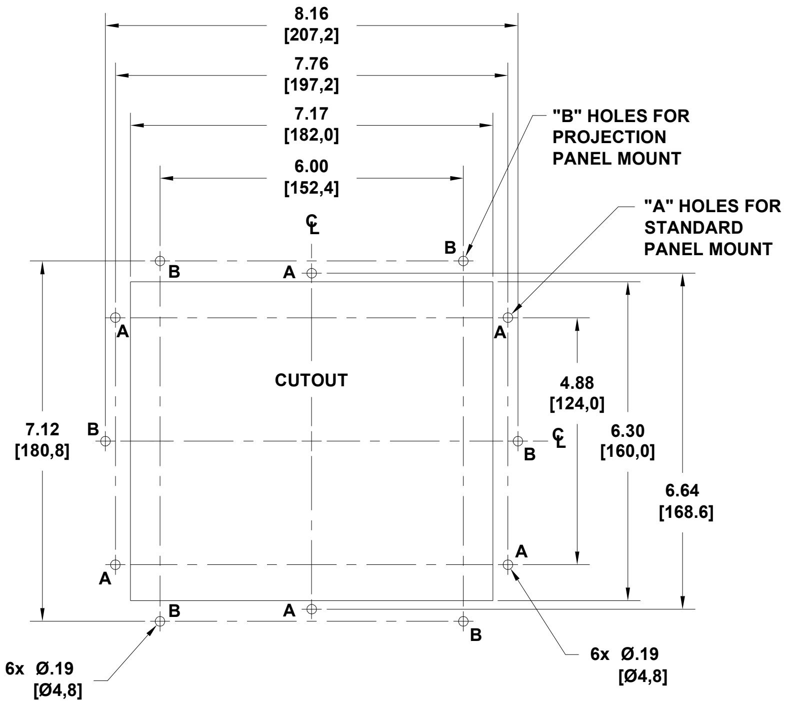
Outline Standard Mount

WARNING **The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).**

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.

Panel Cutout

WARNING **Even when the auxiliary voltage is switched-off, unsafe voltages remain at the device connections.**



Door Cut-out

WARNING **The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).**

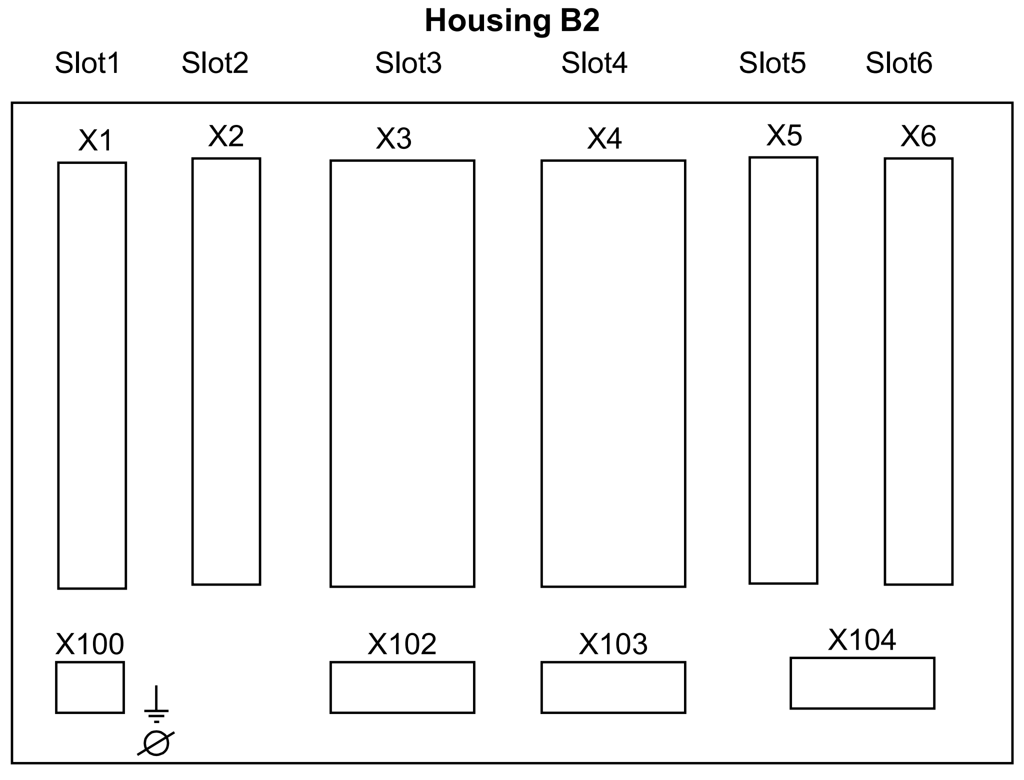
The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2]) / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.

CAUTION **DO NOT over-tighten the mounting nuts of the relay (0.164 x 32). Check the torque by means of a torque wrench (15 lb-in [1.7 Nm]). Over-tightening the mounting nuts could cause personal injury or damage the relay.**

Overview of Slots - Assembly Groups

WARNING **In line with the customers' requirement, the devices are combined in a modular way (in compliance with the order code). In each of the slots, an assembly/group may be integrated. In the following diagram, the terminal assignment of the individual assembly/groups are shown. The exact installation/placement of the individual modules can be determined from the connection diagram attached to the top of your device.**

Overview of Slots



Schematic Diagram

WARNING **The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).**

The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.

Grounding

WARNING

The housing must be carefully grounded. Connect a ground cable (AWG 12-10 [4 to 6 mm^2] / 15 In-lb [1.7 Nm]) to the housing, using the screw that is marked with the ground symbol (at the rear side of the device).

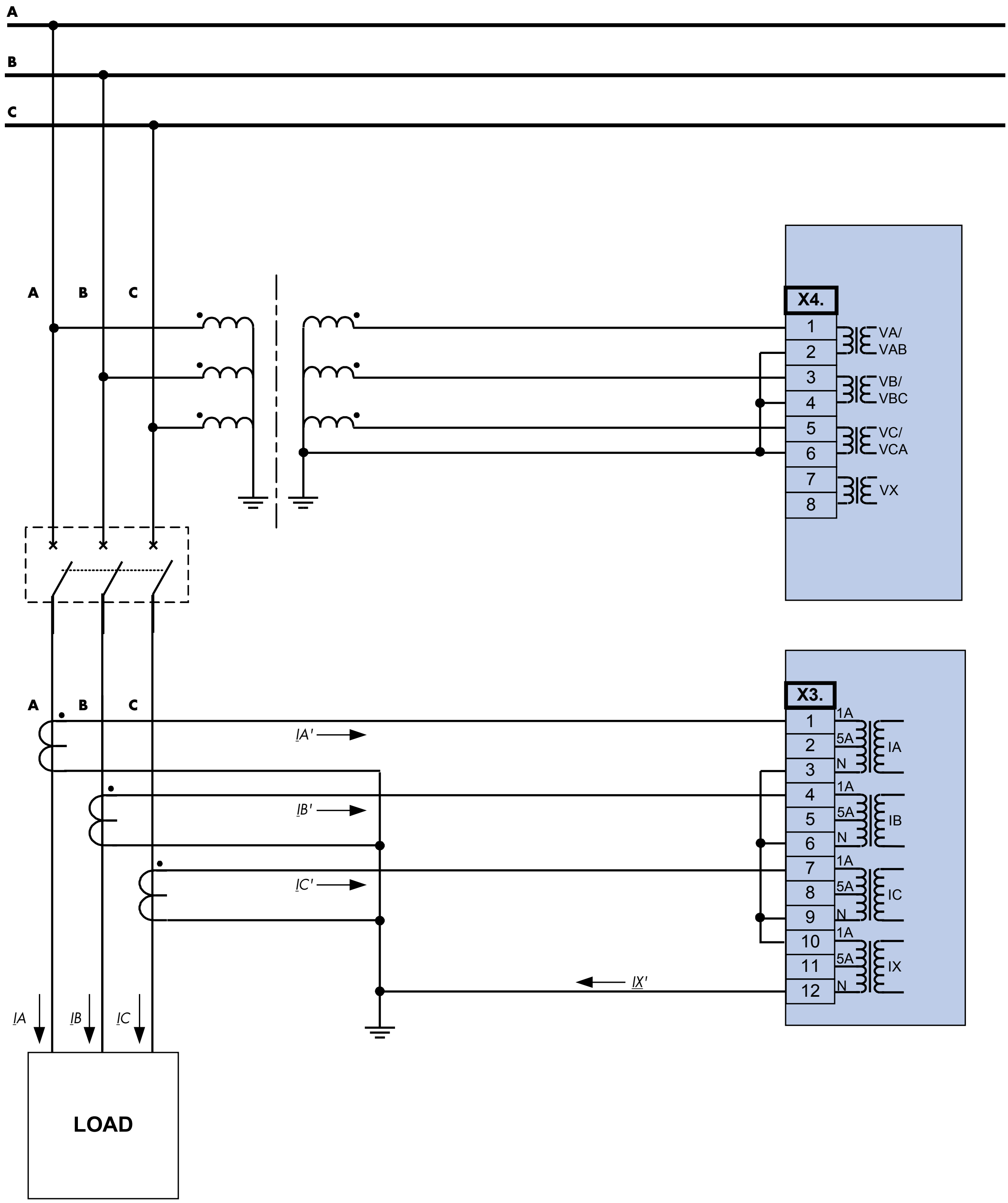
The power supply card needs a separate ground connection (AWG 14 [2.5 mm^2] / 5-7 In-lb [0.56-0.79 Nm]) at terminal X1.

CAUTION

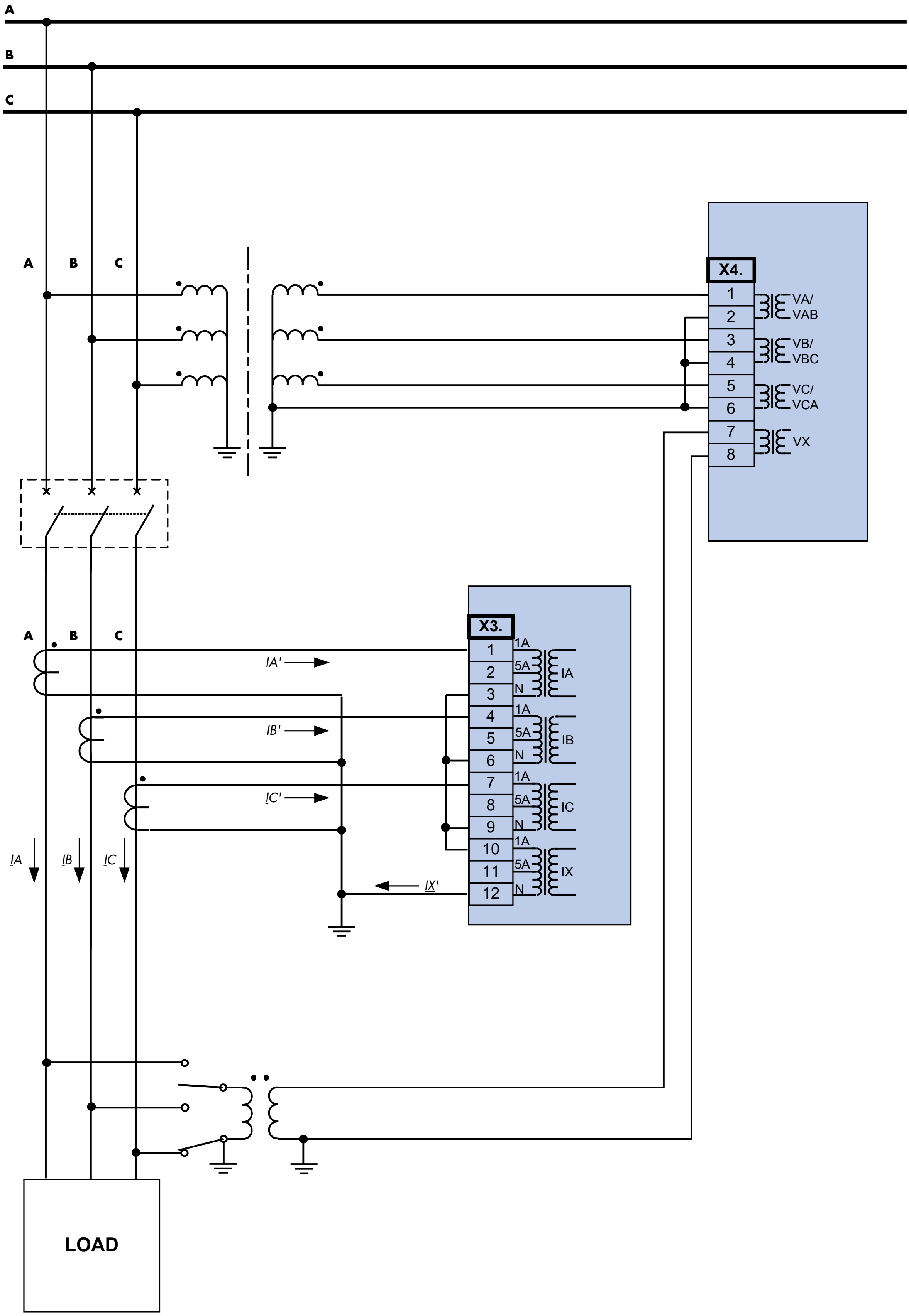
The devices are very sensitive to electrostatic discharges.

Typical Connection Diagrams

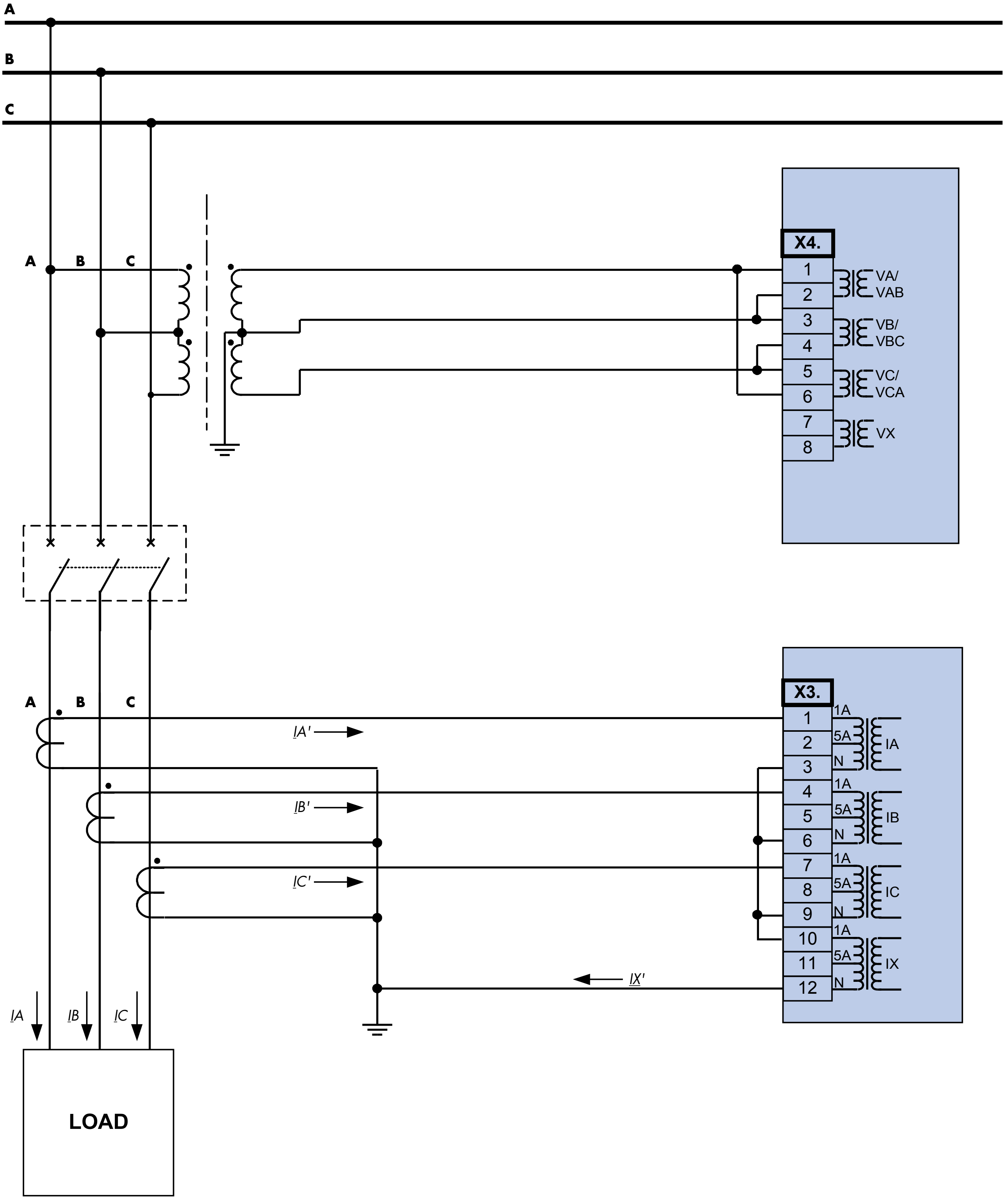
Wye VTs and 5 A CTs in Residual Connection



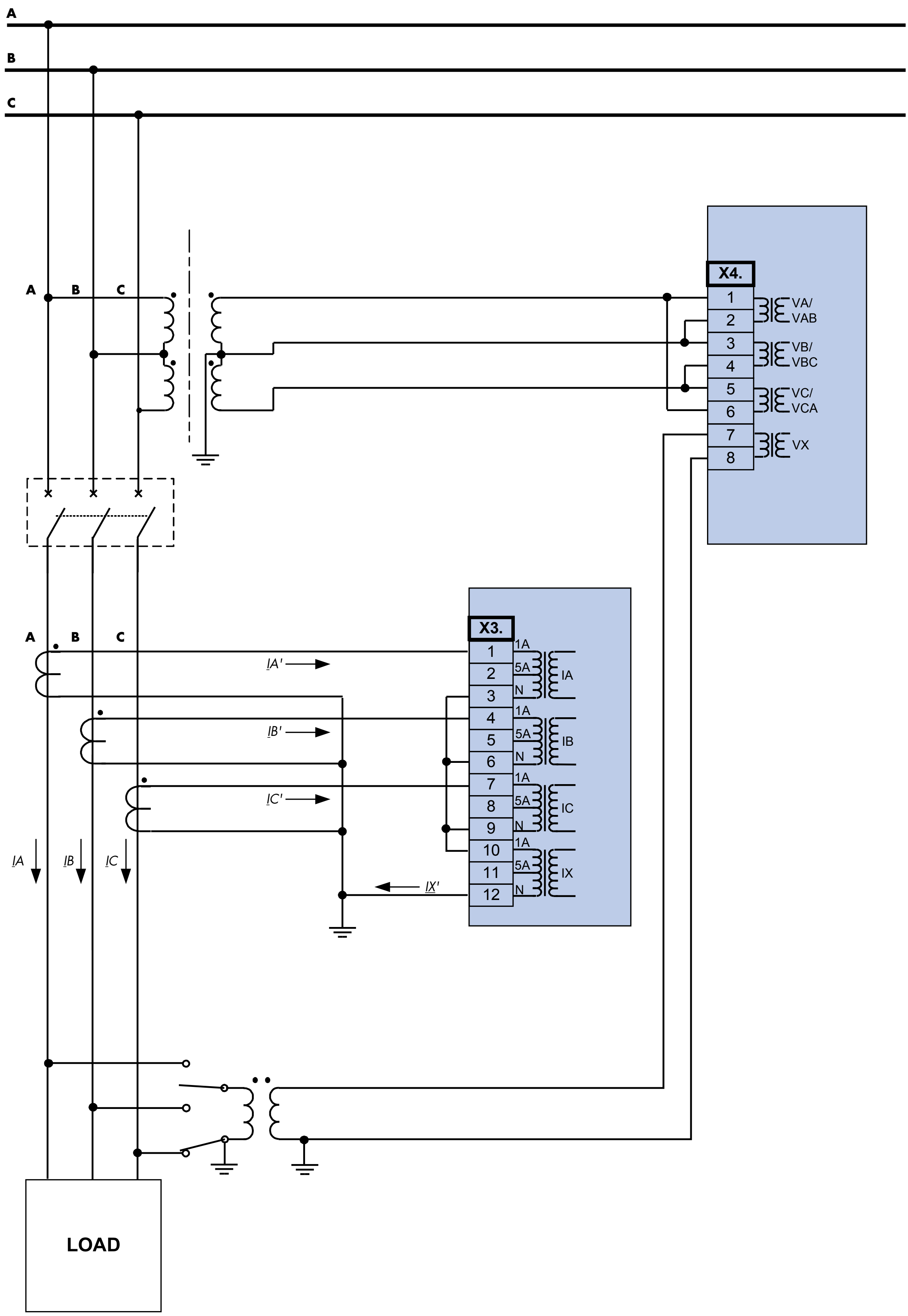
Wye Input Wiring with Aux VX input connected to the load side of the Breaker and 1A CTs in Residual Connection



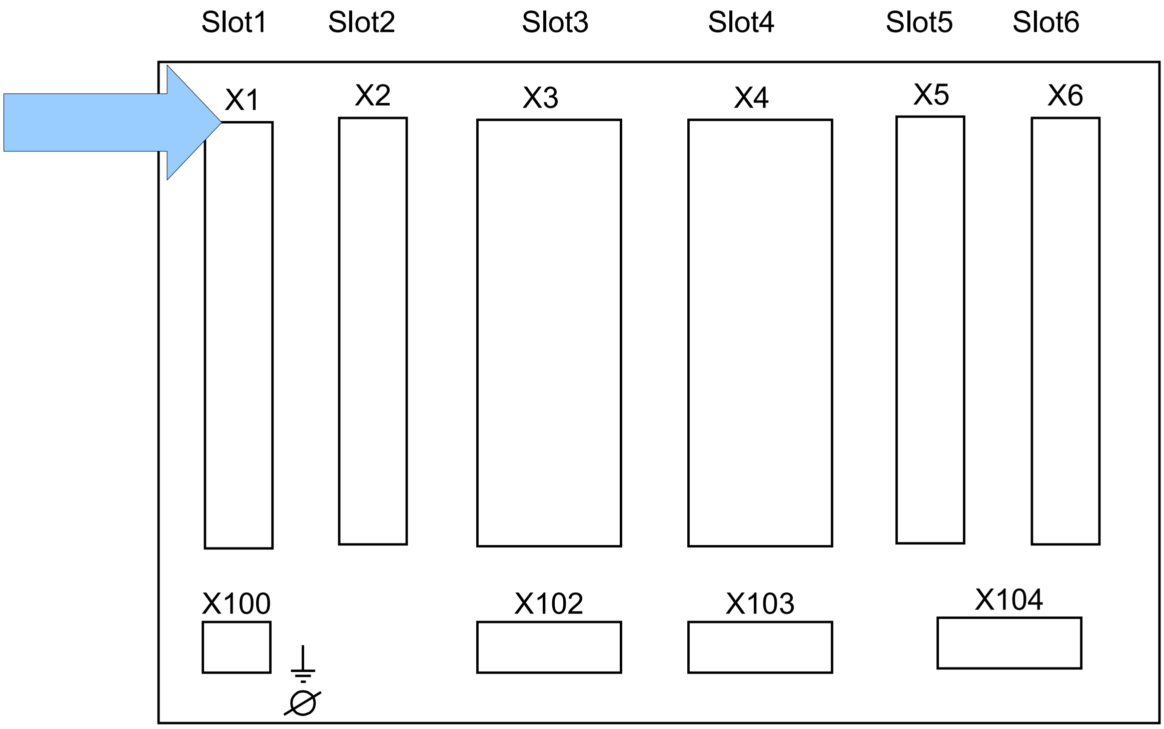
Open Delta VTs Input Wiring and 1 A CTs in Residual Connection



Open Delta VTs Input Wiring with Aux VTs connected to the load side of the breaker and 1A CTs in Residual Connection



Slot X1: Power Supply Card with Digital Inputs



Rear side of the device (Slots)

The type of power supply card and the number of digital inputs on it used in this slot is dependent on the ordered device type. The different variants have a different scope of functions.

Available assembly groups in this slot:

- (**DI8-X1):** This assembly group comprises a wide-range power supply unit; and two non-grouped digital inputs and six (6) digital inputs (grouped).

NOTICE **The available combinations can be gathered from the ordering code.**

DI-8 X - Power Supply and Digital Inputs

WARNING **Make sure that the tightening torque is 5-7 In-lb [0.56-0.79 Nm].**

This assembly group comprises:

- A wide-range power supply unit;
- Two non-grouped digital inputs; and
- Six (6) digital inputs, grouped.

Auxiliary Voltage Supply

- The auxiliary voltage inputs (wide-range power supply unit) are non-polarized. The device can be powered with an AC or DC control voltage.

Digital Inputs

CAUTION **For each digital input group, the related voltage input range has to be configured. Wrong switching thresholds can result in malfunctions/wrong signal transfer times.**

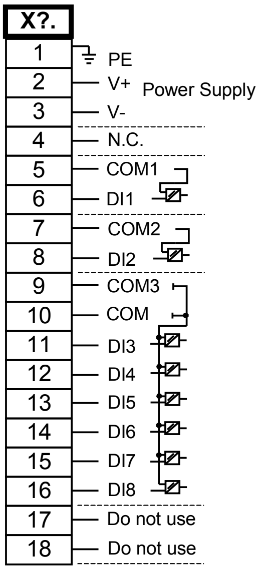
The digital inputs are provided with different switching thresholds (that are configurable) (two AC and five DC input ranges). The following switching levels can be defined:

- 24 Vdc;
- 48 Vdc
- 60 Vdc;
- 110/120 Vac/dc; and
- 230/240 Vac/dc.

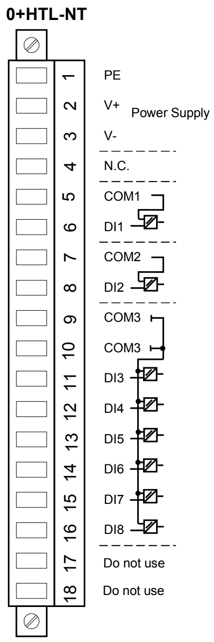
If a voltage >80% of the set switching threshold is applied at the digital input, the state change is recognized (logically “1”). If the voltage is below 40% of the set switching threshold, the device detects logically “0”.

CAUTION **When using DC supply, the negative potential has to be connected to the common terminal (COM1, COM2, COM3 - please see the terminal marking).**

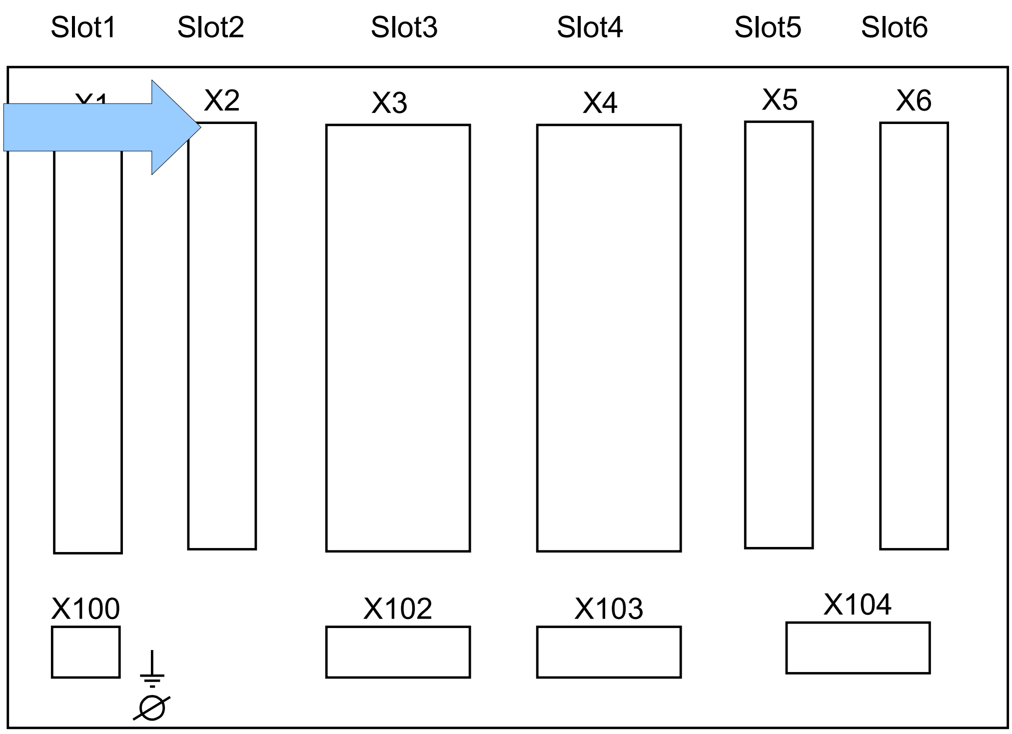
Terminal Marking



Pin Assignment



Slot X2: Relay Output Card, Zone Interlock



Rear side of the device (Slots)

The type of card in this slot is dependent on the ordered device type. The different variants have a different scope of functions.

Available assembly groups in this slot:

- **(RO-4Z X2):** Assembly Group with 4 Relay Outputs (2 Form A and 2 Form C) and Zone Interlocking.

NOTICE **The available combinations can be gathered from the ordering code.**

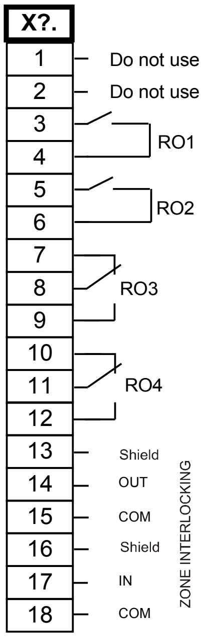
RO-ZI X - Relay Outputs and Zone Interlock

The Relay Outputs are potential-free contacts. In the Assignment/Relay Outputs section, the assignment of the Relay Outputs is specified. The changeable signals are listed in the Assignment List section.

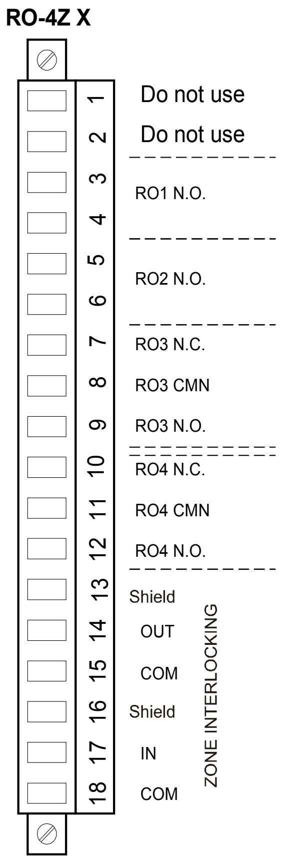
WARNING **Make sure that the tightening torque is 5-7 In-lb [0.56-0.79 Nm].**

CAUTION **Please carefully consider the current carrying capacity of the Relay Outputs. Please refer to the Technical Data.**

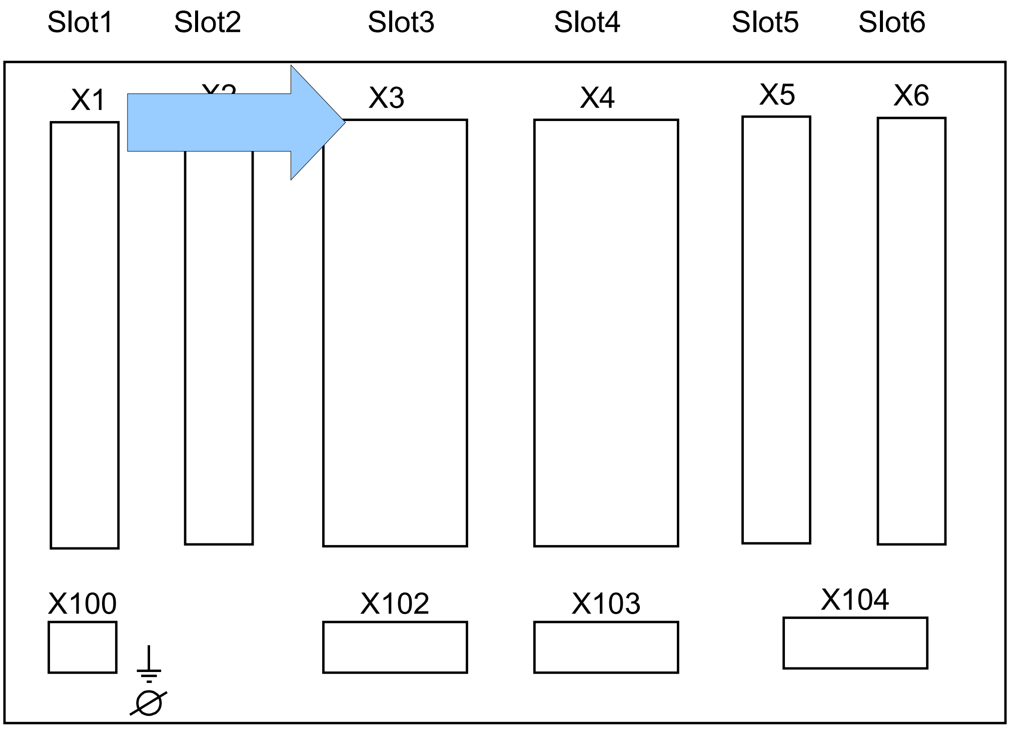
Terminal Marking



Pin Assignment



Slot X3: Current Transformer Measuring Inputs



Rear side of the device (Slots)

This slot contains the current transformer measuring inputs.

Current Measuring Inputs and Ground Current Measuring Input

A current measuring card is provided with four (4) current measuring inputs: three for measuring the phase currents and one for measuring of the ground current.
Each of the current measuring inputs has a measuring input for 1 A and 5 A.

The input for ground current measuring either can be connected to a zero sequence current transformer or, alternatively, it is possible to connect the summation current path of the phase current transformer to this input (residual connection).

DANGER **Current transformers have to be earth grounded on their secondary side.**

DANGER **Interrupting the secondary circuits of current transformers causes hazardous voltages.**

The secondary side of the current transformers have to be short circuited before the current circuit to the device is opened.

DANGER **The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).**

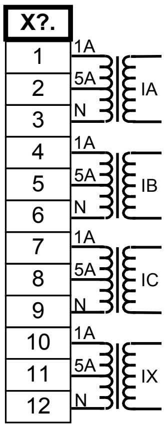
WARNING

- **Do not mix the inputs (1 A/5 A).**
- **Make sure the transformer ratios and the power of the CTs are correctly rated. If the rating of the CTs is not correct (overrated), then the normal operational conditions may not be recognized. The pickup value of the measuring unit amounts to approximately 3% of the rated current of the device. Also, the CTs need a current greater than approximately 3% of the rated current to ensure sufficient accuracy.**

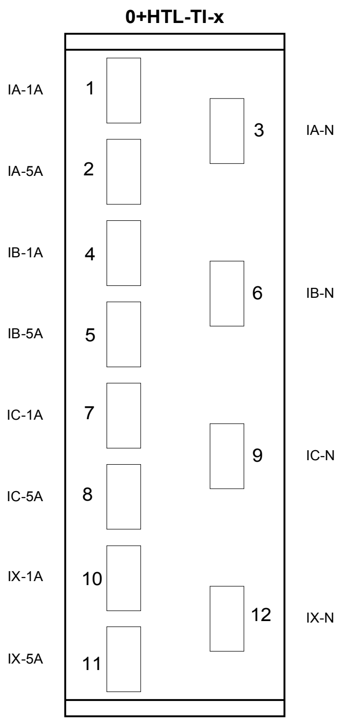
  Example: For a 600 A CT (primary current), any currents below 18 A cannot be detected.
- **Overloading can result in destruction of the measuring inputs or faulty signals. Overloading means that, in case of a short circuit, the current carrying capacity of the measuring inputs could be exceeded.**

WARNING **Make sure that the tightening torque is 17.7 In-lb [2 Nm].**

Terminal Markings



Pin Assignment



Common CT Wiring Configurations

Check the installation direction.

DANGER **It is imperative that the secondary sides of measuring transformers be grounded.**

DANGER **The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).**

WARNING **CT secondary circuits must always to be low-burdened or short-circuited during operation.**

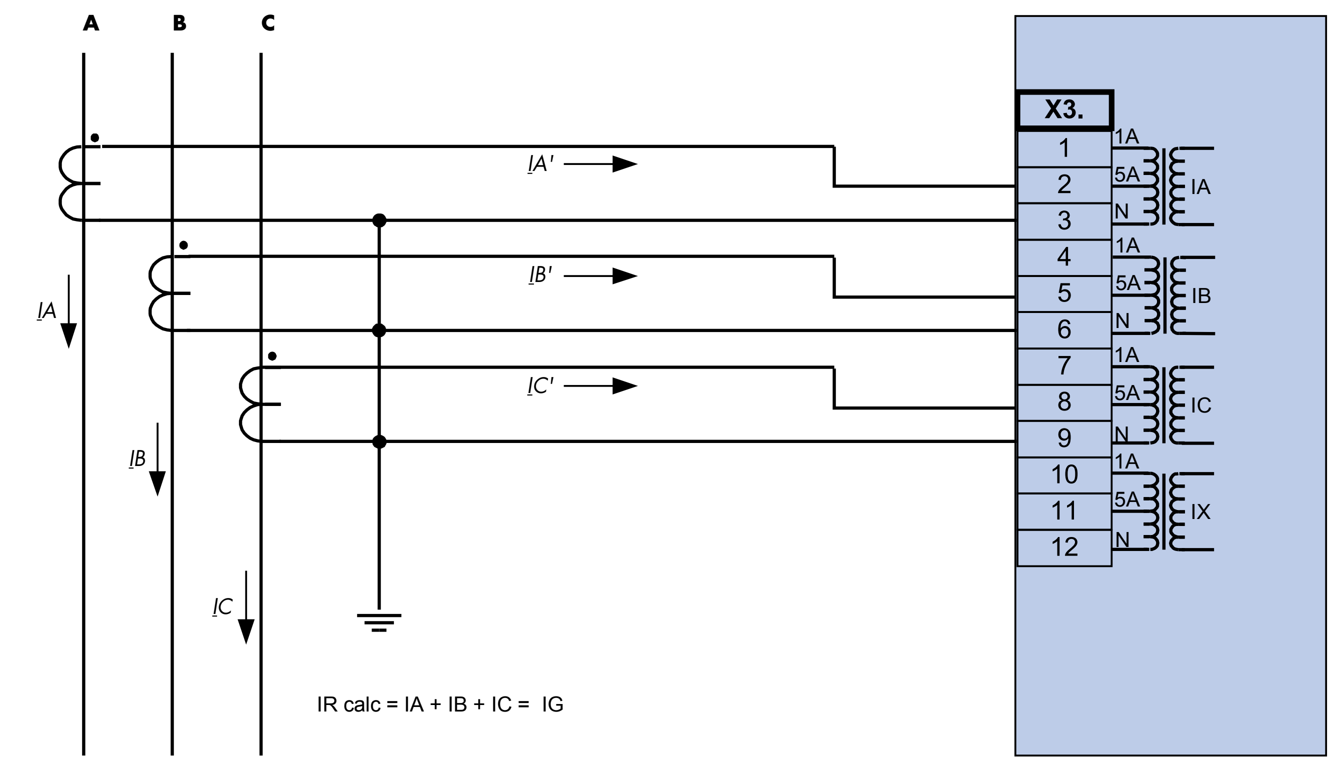
NOTICE **For current and voltage sensing function external wired and appropriate current and voltage transformer shall be used, based on the required input measurement ratings. Those devices provide the necessary insulation functionality.**

All current measuring inputs can be provided with 1 A or 5 A nominal. Make sure that the wiring is correct.

CT Connection Options

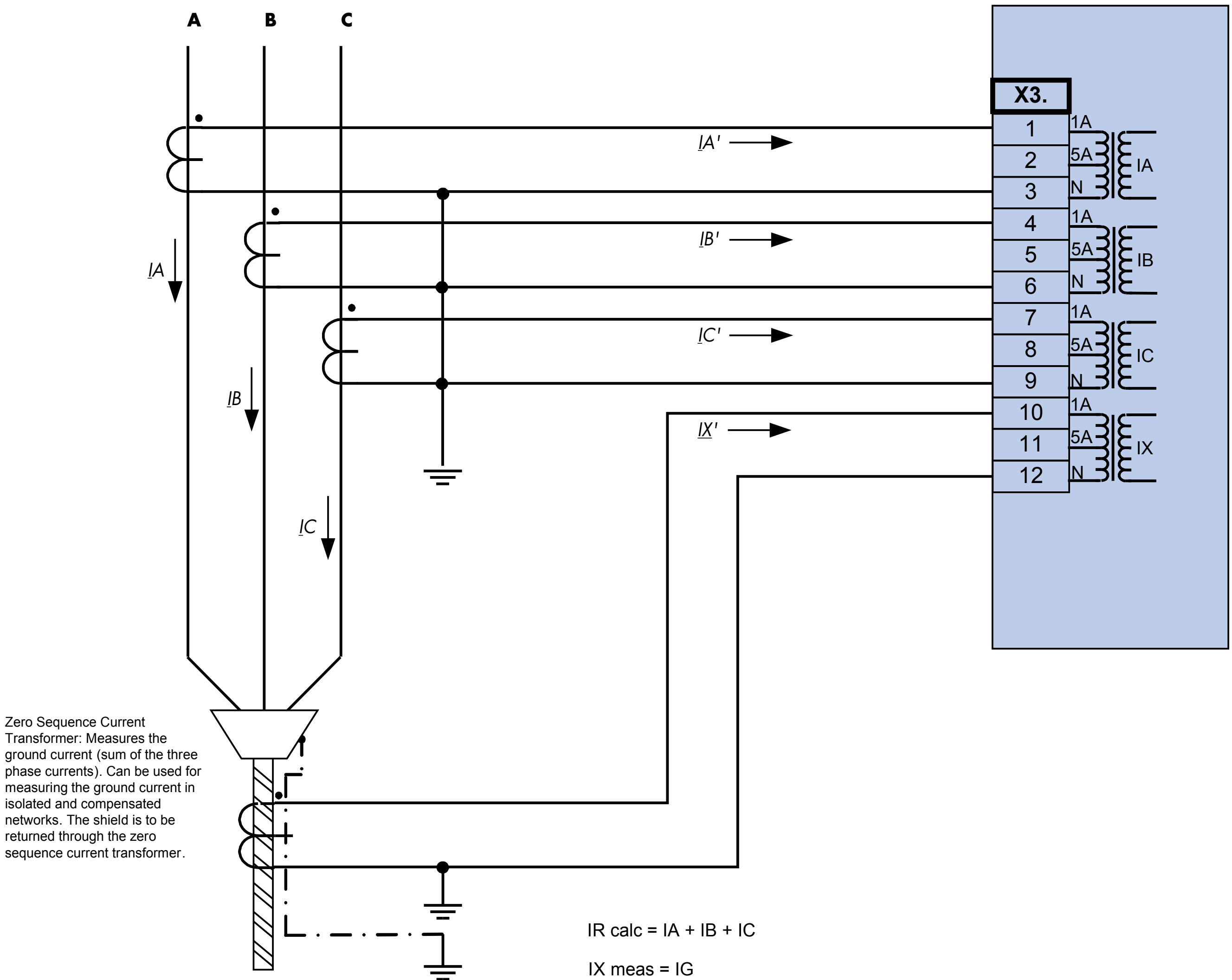
The current transformers may be connected in several ways, and the specified configuration affects the way system measurements are made and results computed. The computation of the residual current IR, is dependent on the system configuration setting for the CT connection. The configurations resulting from the setting options are shown as well as the calculated IR residual current.

3-phase, 3-wire IG Calculated



Three-phase Current Measurement; Inom Secondary = 5 A.

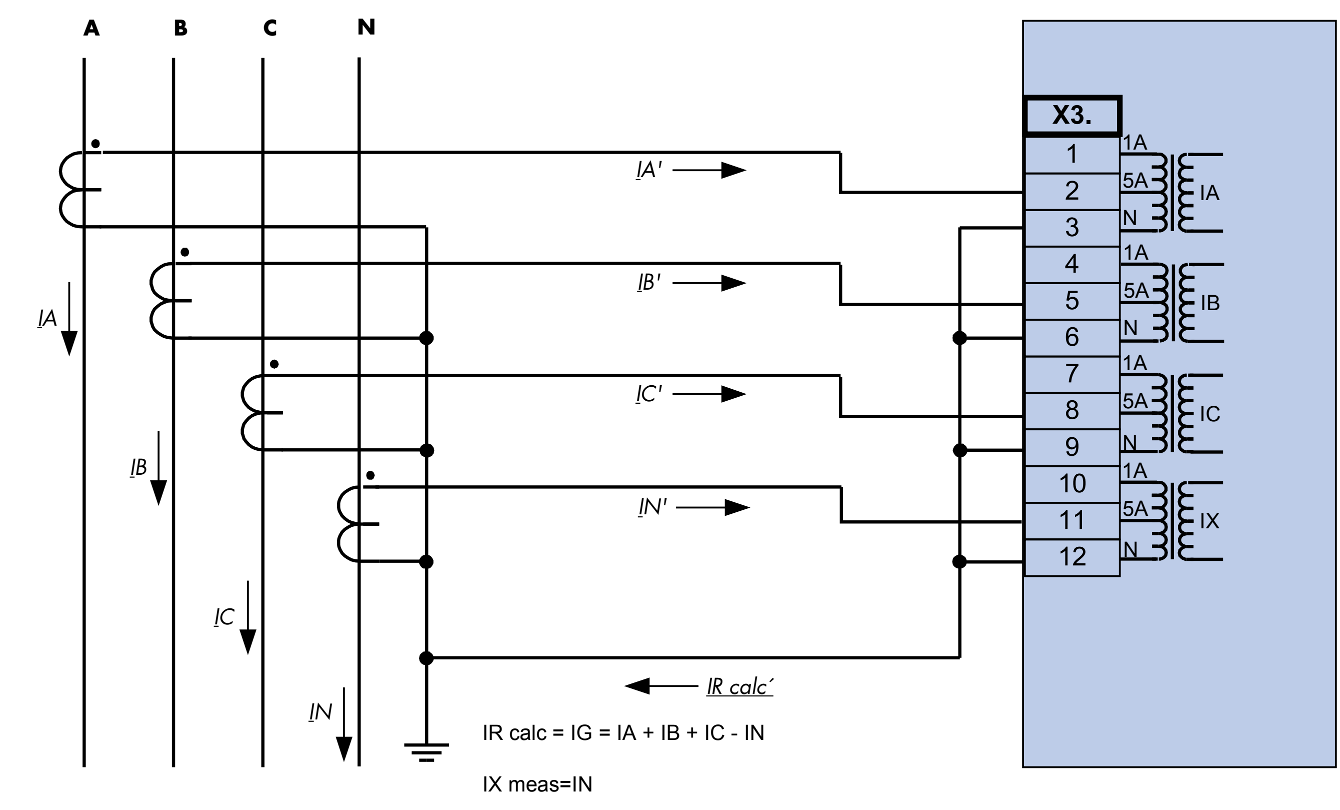
3-phase, 3-wire IG Measured



Three-phase Current Measurement; Inom Secondary = 1 A.
Ground Current Measuring via Zero Sequence CT ; IGnom Secondary = 1 A.

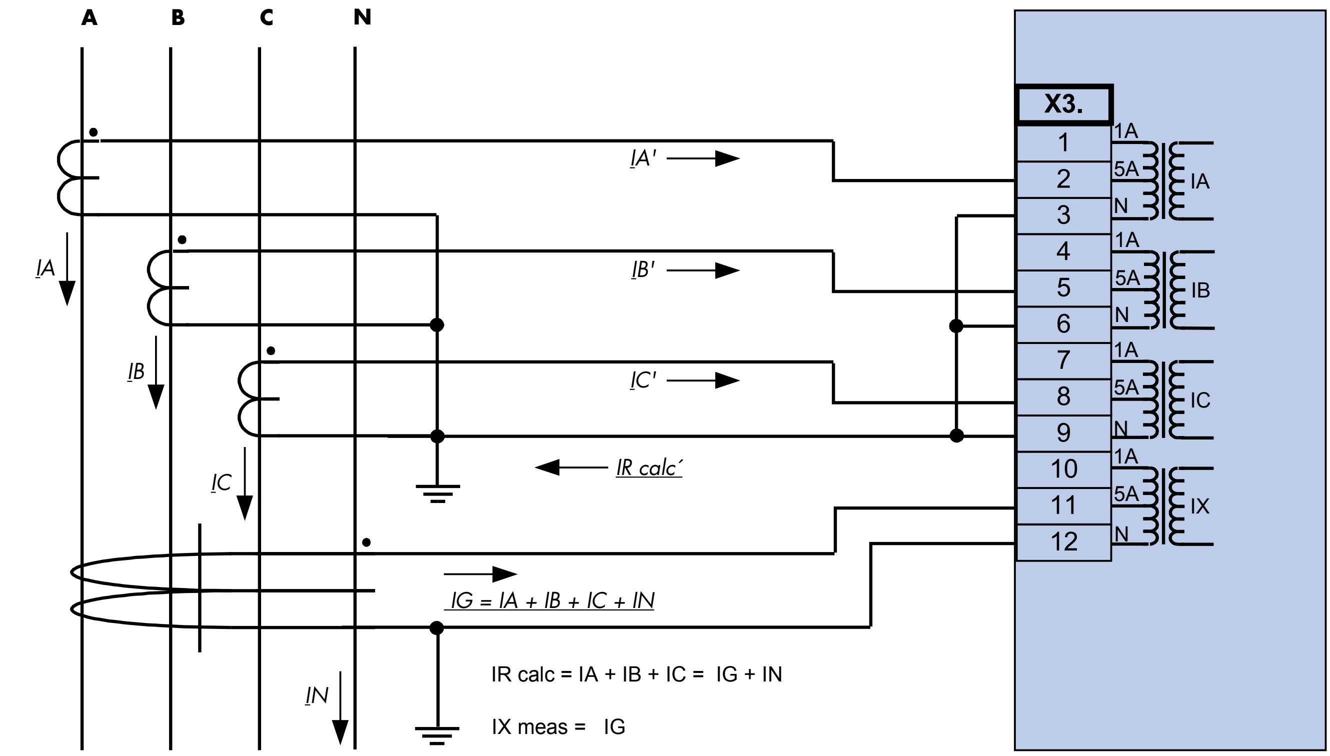
Warning!
The shielding at the dismantled end of the line has to be put through the zero sequence current transformer and has to be grounded at the cable side.

4-wire system, 4th CT on Neutral



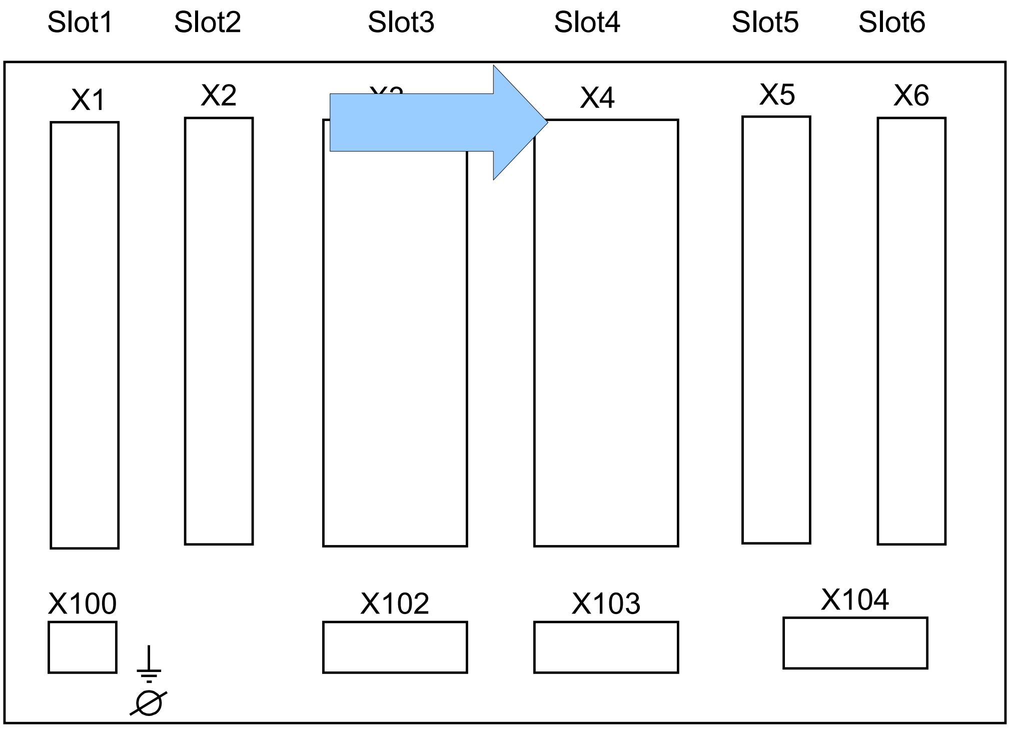
4-wire system, 4th CT on Neutral; In secondary = 5 A.

4-wire System Ground Current CT Involving Neutral



4-wire system with ground current CT (Torodial) involving Neutral; In secondary = 5 A.

Slot X4: Voltage Transformer Measuring Inputs



Rear side of the device (Slots)

This slot contains the voltage transformer measuring inputs.

Voltage Measuring Inputs

The device is provided with 4 voltage measuring inputs. Three for measuring the mains voltages (*»VAB«, »VBC« , »VCA« - in case of Open Delta*) or phase-to-neutral voltages (*»VA«, »VB«, »VC« in case of Wye*). The fourth measuring input is to be used for *»VX«*.

WARNING **Make sure that the tightening torque is 1.2-1-6 Nm [11-15 In-lb].**

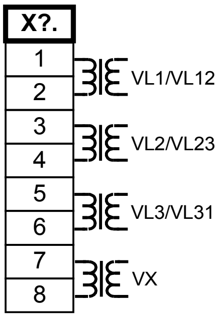
CAUTION **The rotating field of your power supply system has to be taken in to account. Make sure that the voltage transformers are wired correctly.**

For the Open Delta connection the system parameter »Main VT con« has to be set to »Open Delta«.

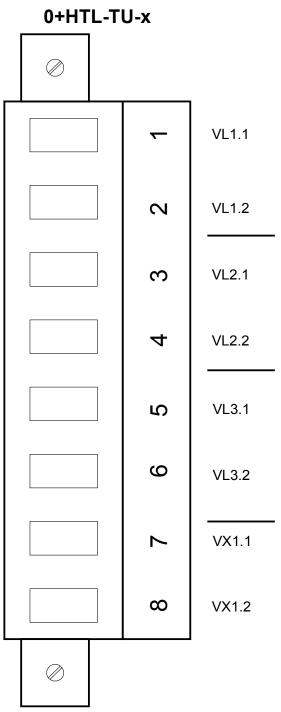
For the Wye connection the system parameter »Main VT con« has to be set to »Wye«.

Please refer to the Technical Data.

Terminal Marking



Pin assignment



Common VT Wirings

Check the installation direction of the VTs.

DANGER **It is imperative that the secondary sides of measuring transformers be grounded.**

NOTICE **For current and voltage sensing function, externally wired and appropriate current and voltage transformer must be used, based on the required input measurement ratings. Those devices provide the necessary insulation functionality.**

VT Check Measuring Values

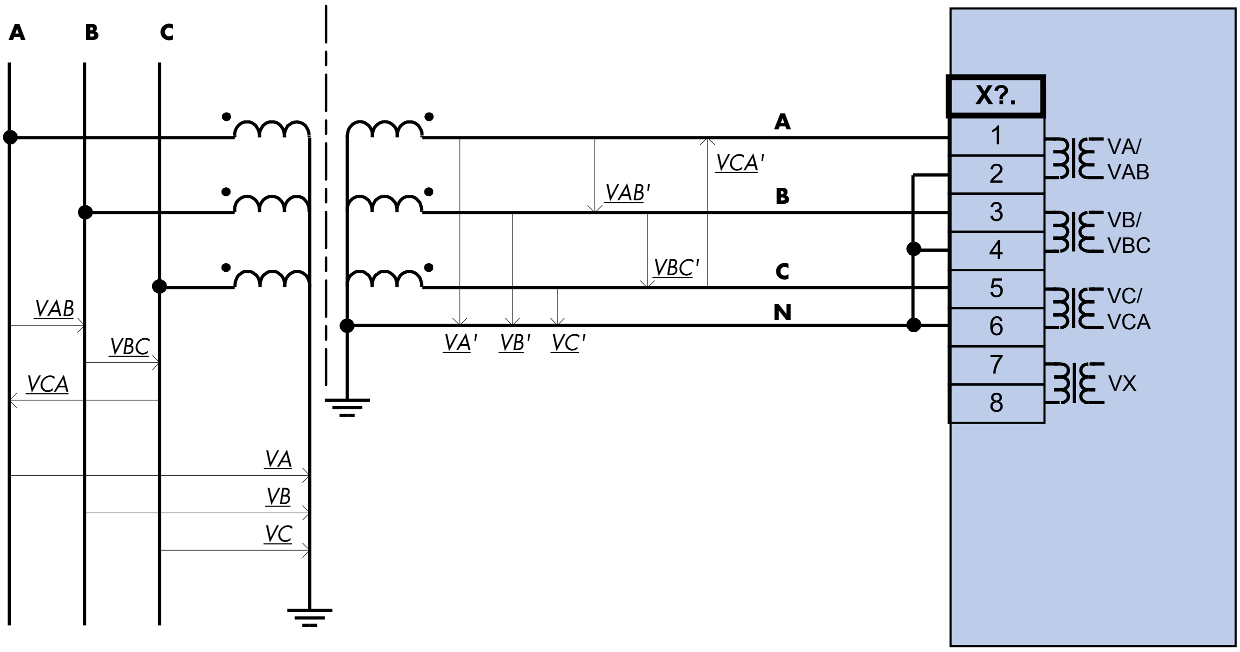
Connect a three-phase measuring voltage equal to the rated voltage to the relay.

NOTICE **Take the connection of the measuring transformers (open delta/Wye connection) into account.**

Now adjust the voltage values in the nominal voltage range with the corresponding nominal frequencies that are not likely to cause over-voltage or under-voltage trips.

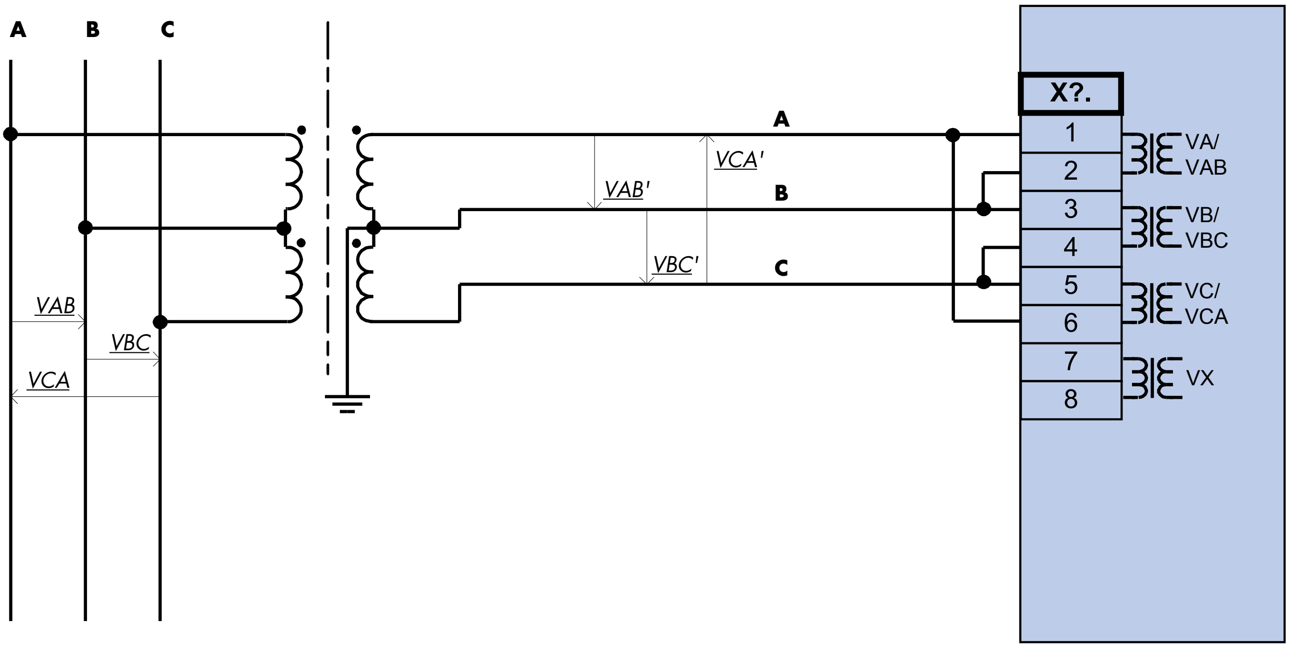
Compare the values shown in the device display with the readings of the measuring instruments. The deviation must be according to the specifications in the Technical Data. section

VT Wye



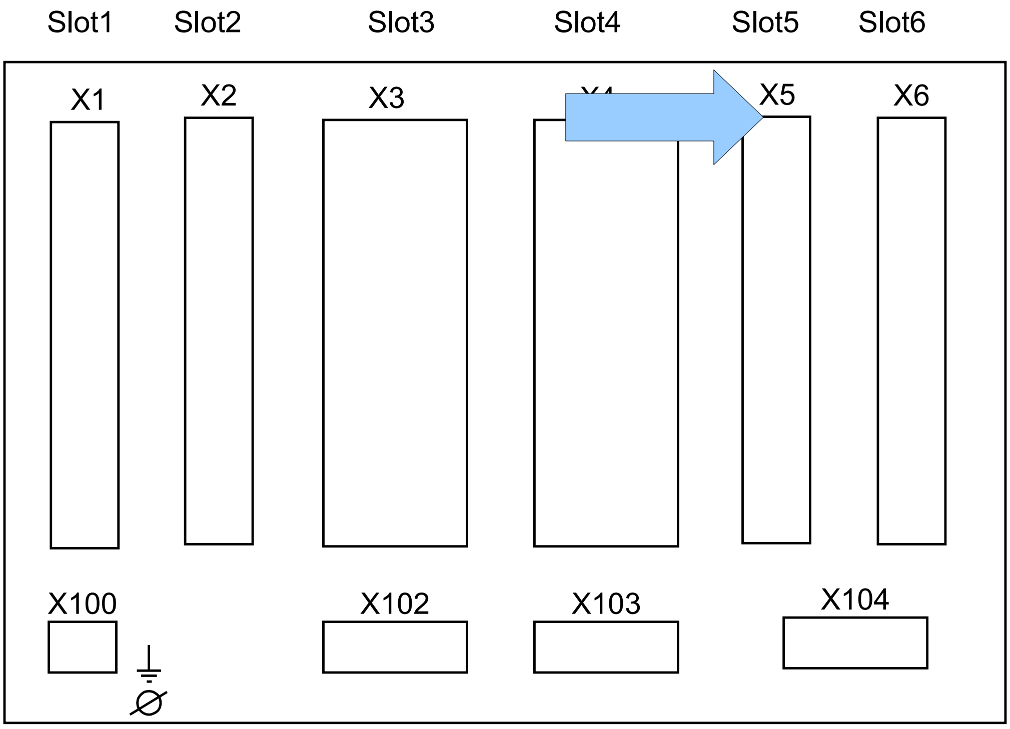
Three-phase voltage measurement - wiring of the measurement inputs: "Wye"

VT Open Delta



Two-phase voltage measurement - wiring of the measuring inputs: "Open Delta"

Slot X5: Relay Output Card



Rear side of the device (Slots)

The type of card in this slot is dependent on the ordered device type. The different variants have a different scope of functions.

Available assembly groups in this slot:

- **(RO-6 X5):** Assembly Group with 6 Relay Outputs (Form C).

NOTICE **The available combinations can be gathered from the ordering code.**

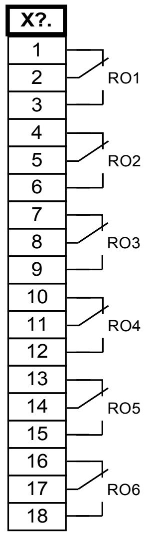
RO-6 X - Relay Outputs

The Relay Outputs are potential-free contacts. In the Assignment/Relay Outputs section, the assignment of the Relay Outputs is specified. The changeable signals are listed in the Assignment List section.

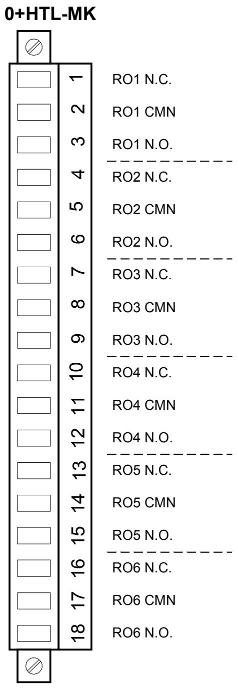
WARNING **Make sure that the tightening torque is 5-7 In-lb [0.56-0.79 Nm].**

CAUTION **Please carefully consider the current carrying capacity of the Relay Outputs. Please refer to the Technical Data.**

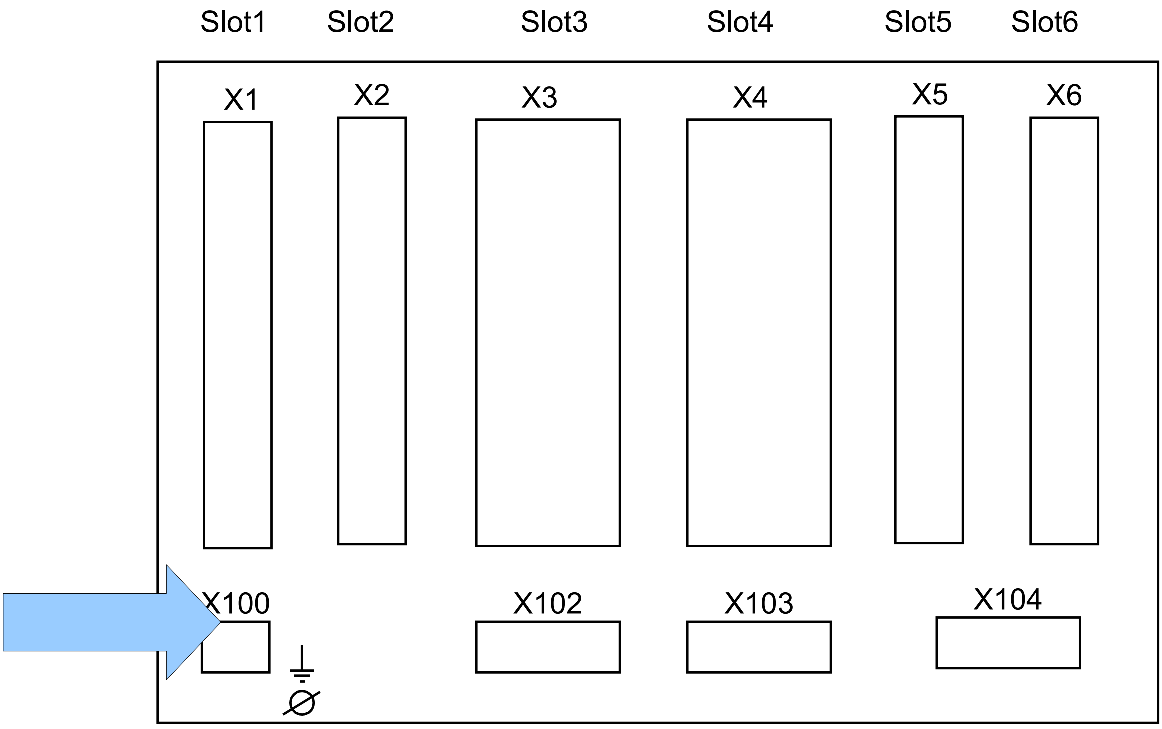
Terminal Marking



Pin Assignment



Slot X100: Ethernet Interface

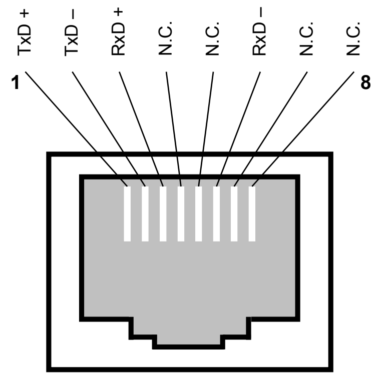


Rear side of the device (Slots)

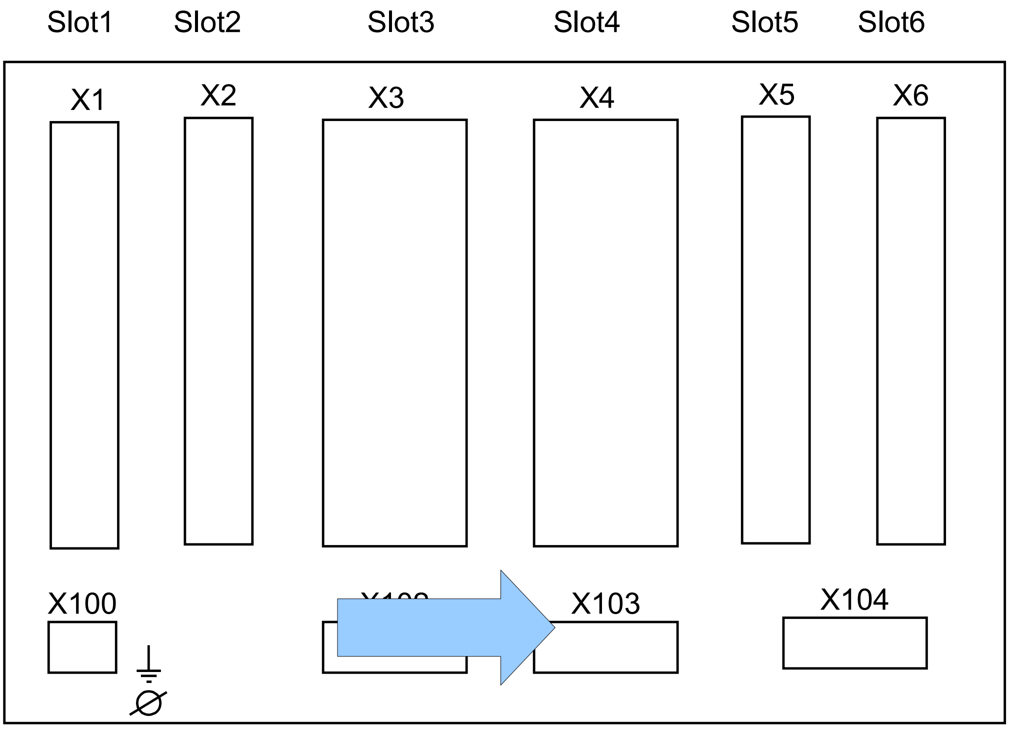
An Ethernet interface may be available depending on the device type ordered.

NOTICE **The available combinations can be gathered from the ordering code.**

Ethernet - RJ45

Terminal Marking


Slot X103: Data Communication



Rear side of the device (Slots)

The data communication interface in the **X103** slot is dependent on the ordered device type. The scope of functions is dependent on the type of data communication interface.

Available assembly groups in this slot:

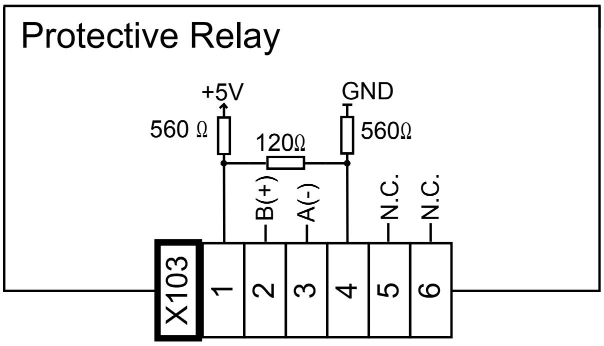
- RS485 Terminals

NOTICE **The available combinations can be gathered from the ordering code.**

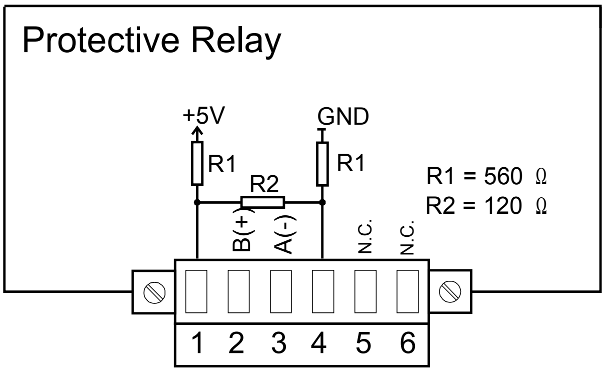
RS485 - Modbus® RTU

WARNING **Make sure that the tightening torque is 2-4 In-lb [0.22-0.45 Nm].**

Terminal Marking



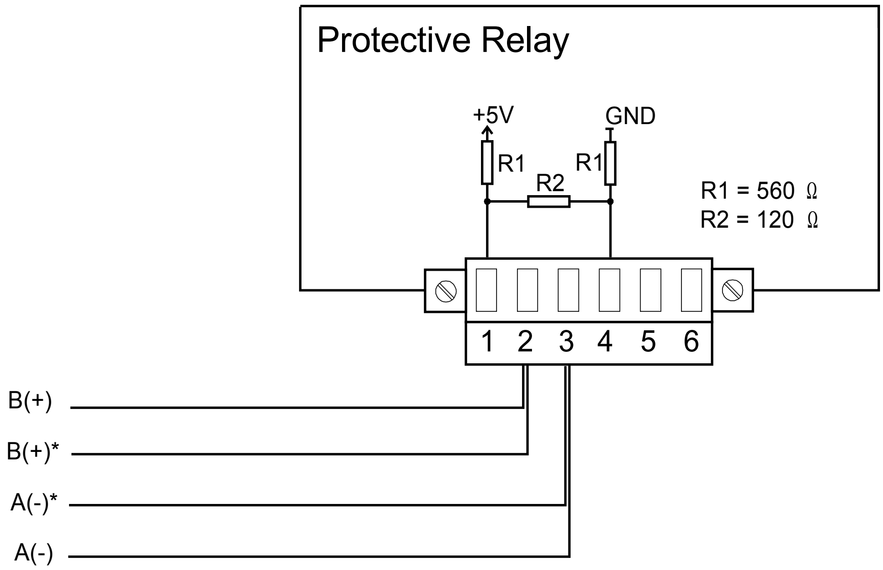
Pin Assignment



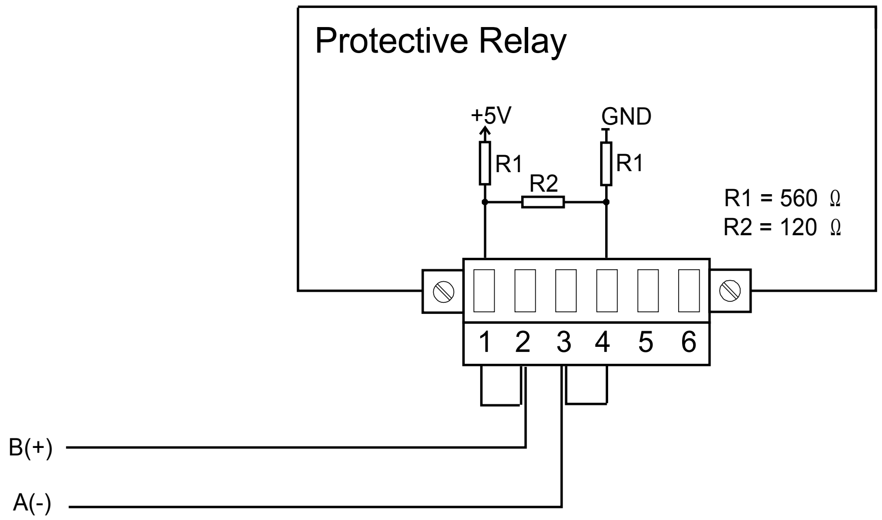
NOTICE **The Modbus® connection cable must be shielded. The shielding has to be fixed at the screw that is marked with the ground symbol at the rear side of the device.**

The communication is Half Duplex.

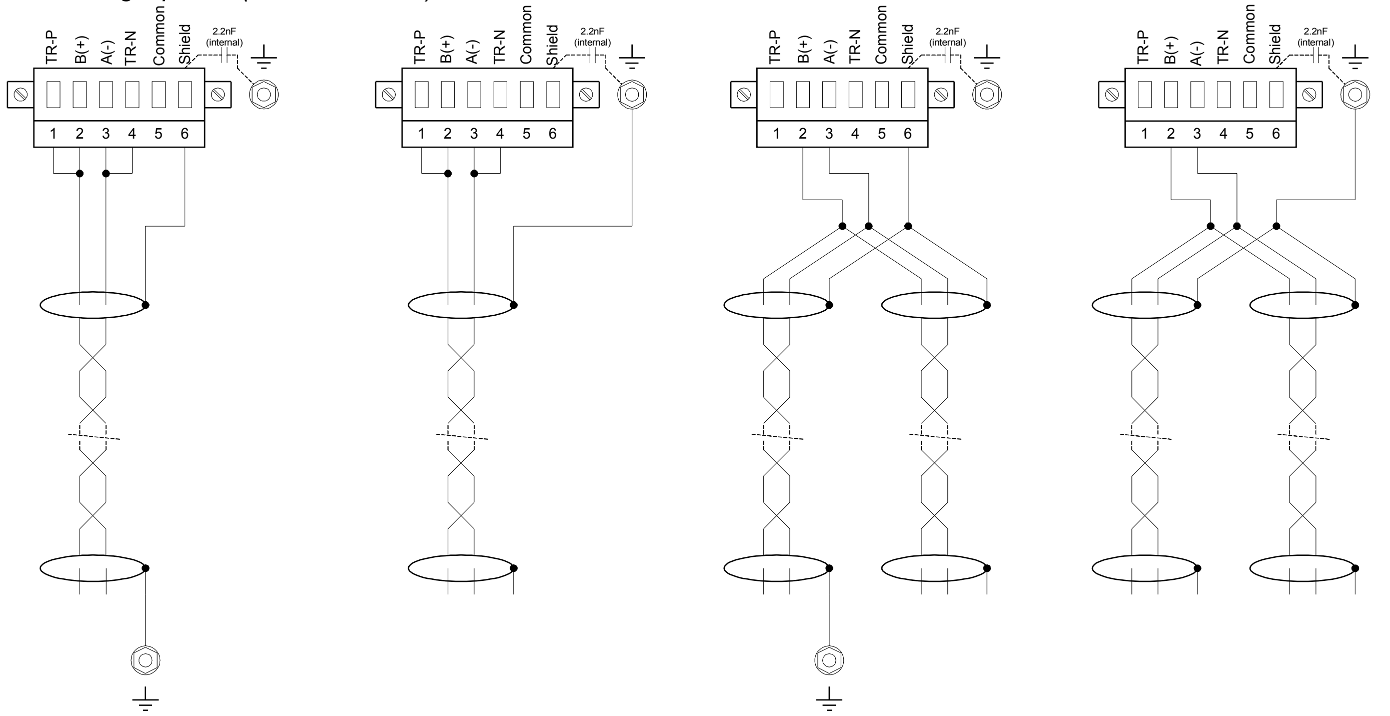
Wiring Example: Device in the Middle of the Bus



Wiring Example: Device at the End of the BUS (Using the Integrated Terminal Resistor)



Shielding Options (2-wire + Shield)



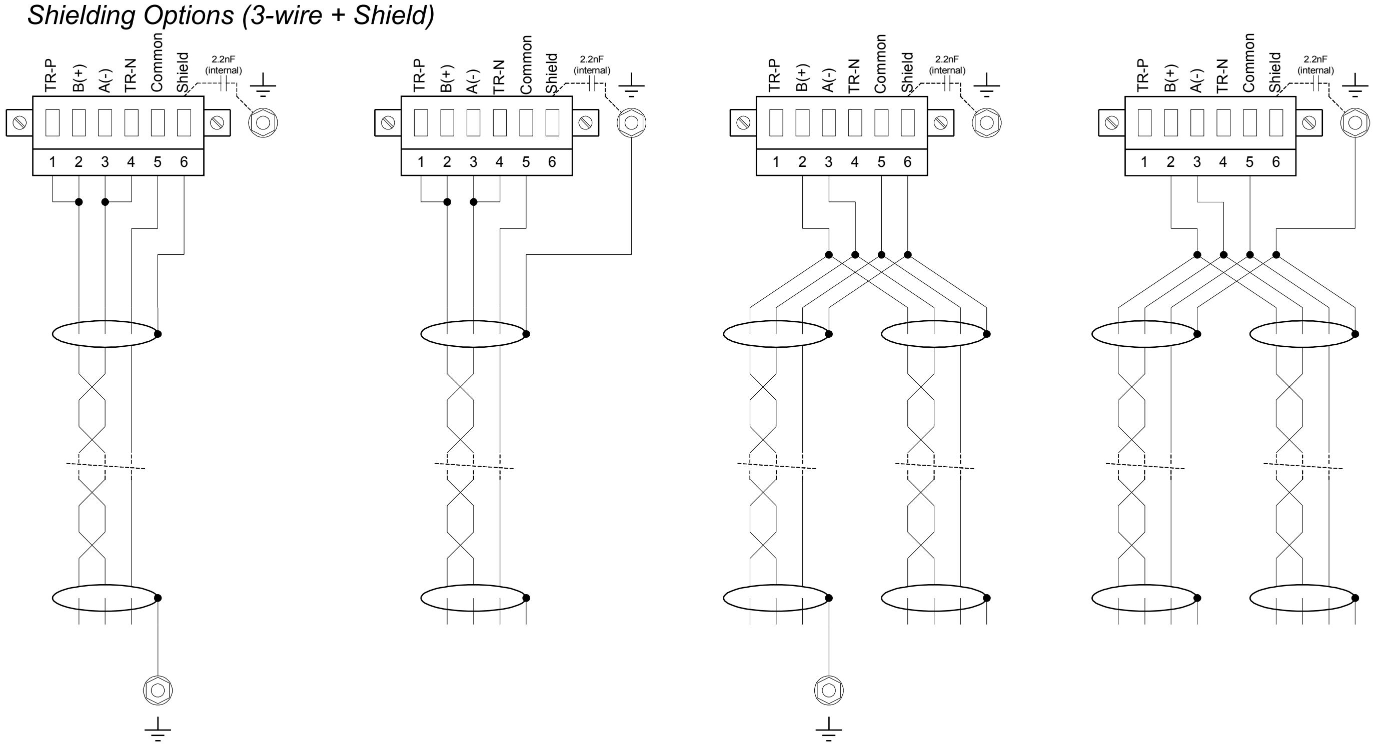
Shield at bus master side connected to earth termination resistors used

Shield at bus device side connected to earth termination resistors used

Shield at bus master side connected to earth termination resistors not used

Shield at bus device side connected to earth termination resistors not used

Shielding Options (3-wire + Shield)



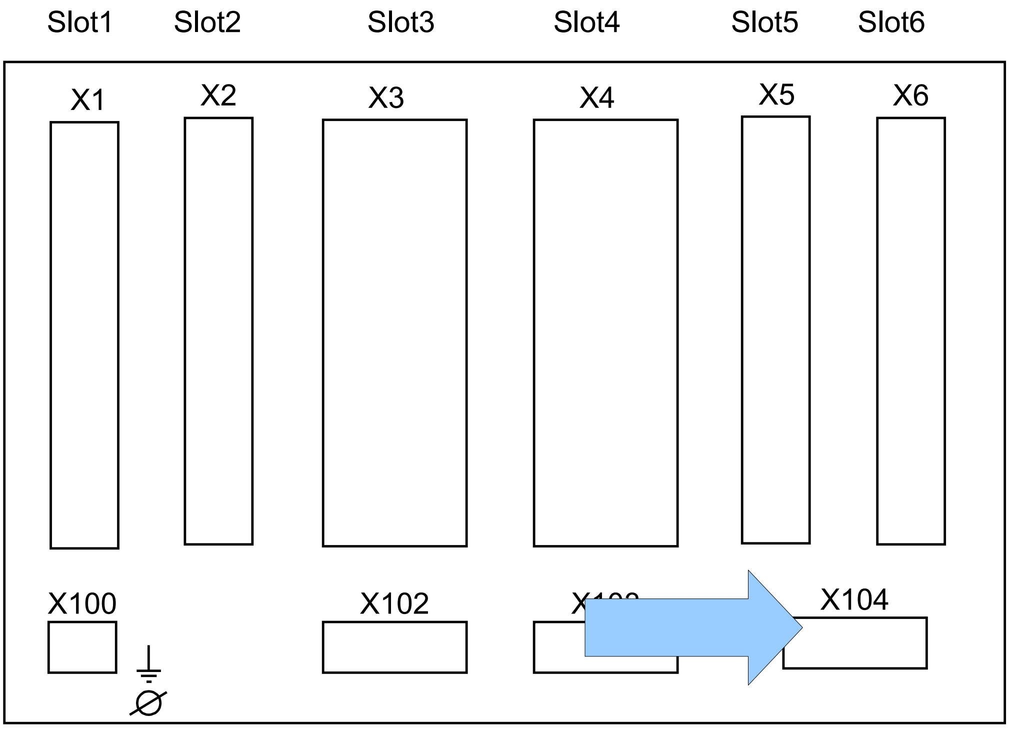
Shield at bus master side connected to earth termination resistors used

Shield at bus device side connected to earth termination resistors used

Shield at bus master side connected to earth termination resistors not used

Shield at bus device side connected to earth termination resistors not used

Slot X104: IRIG-B00X and Supervision Contact



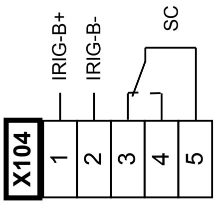
Rear side of the device (Slots)

This comprises the IRIG-B00X and the System contact (Supervision Contact).

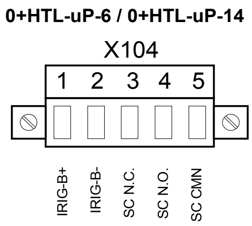
System Contact and IRIG-B00X

WARNING **Make sure that the tightening torque is 5-7 In-lb [0.56-0.79 Nm].**

Terminals



Pin Assignment for Device



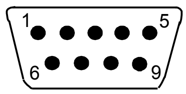
The Supervision Contact (SC) closes after the boot phase of the device if the protection is working. This Supervision Contact (SC) will open if an internal device error has occurred (please refer to the Self Supervision section).

The *System-OK contact (SC relay)* cannot be configured. The system contact is a Form "C" contact that picks up when the device is free from internal faults. While the device is booting up, the *System OK relay (SC)* remains dropped-off (unenergized). As soon as the system is properly started, the System Contact picks up and the assigned LED is activated accordingly (please refer to the Self Supervision section).

PC Interface - X120

The interface is a 9-pole D-Sub at all device fronts.

Pin Assignment



1 DCD

2 RxD

3 TxD

4 DTR

5 GND

6 DSR

7 RTS

8 CTS

9 RI

Housing shielded

Assignment of the Null Modem Cable

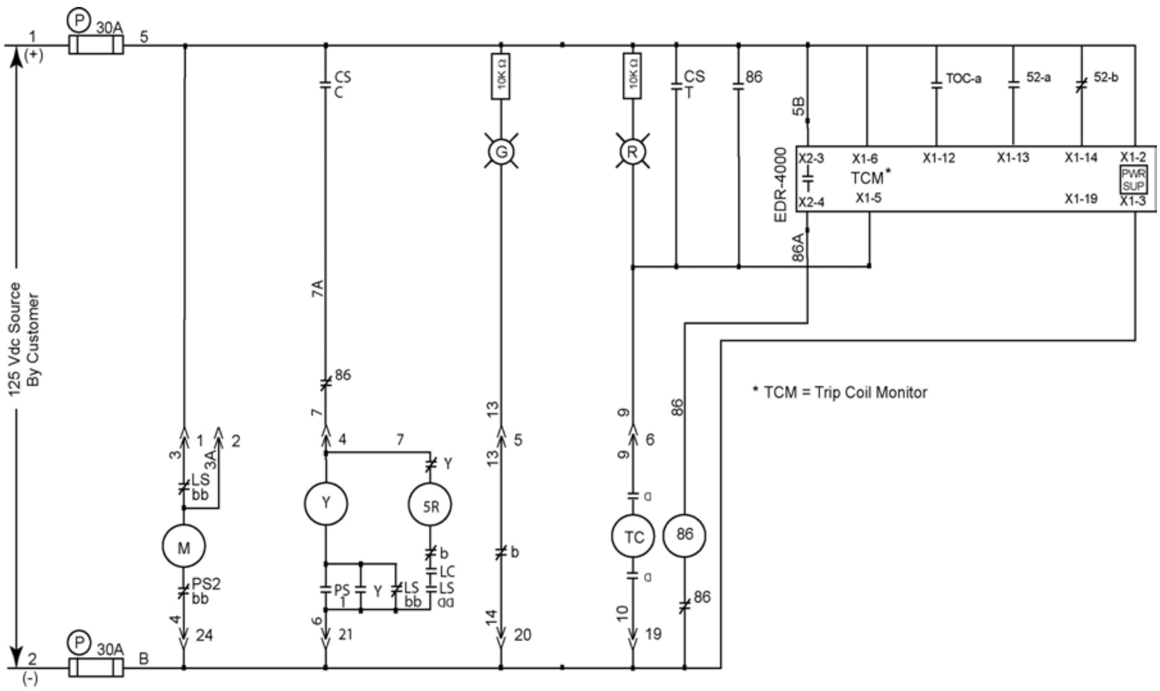
Assignment of the fully wired, null modem cable.

Dsub -9 (Female)	*Signal*	*Dsub -9 (Female)*	*Signal*
2	RxD	3	TxD
3	TxD	2	RxD
4	DTR	6,1	DSR, DCD
6,1	DSR, DCD	4	DTR
7	RTS	8	CTS
8	CTS	7	RTS
5	GND (Ground)	5	GND (Ground)
9	Ring Signal	9	Ring Signal

NOTICE **The connection cable must be shielded.**

Control Wiring Diagram

Below is the recommended control wiring schematic for the EDR-4000.



Schematic for Feeder Breaker (DEV 52)
Vertical Section No. 3B

Wiring Diagrams

Please refer to the file "edr-4000_wiring_diagrams.pdf" on your manual CD.

Input, Output and LED Settings

Digital Input Configuration

The State of the Digital Inputs can be checked within menu:

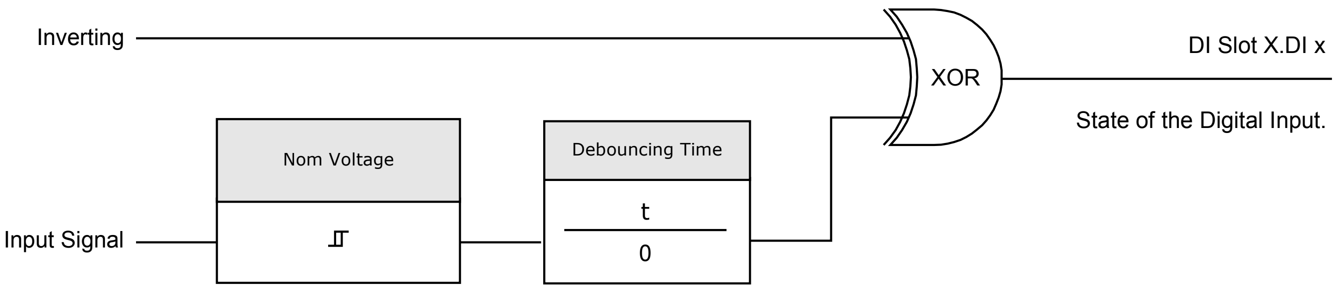
[Operations/Status Display/Name of the assembly group (e.g. DI-8X)]

The Digital Inputs can be configured within menu:

[Device Para/Digital Inputs/Name of the assembly group (e.g. DI-8X)/Group X]

Set the following parameters for each of the digital inputs:

- *»Nominal voltage«;*
- *»Debouncing time«*: A state change will only be adopted by the digital input after the debouncing time has expired; and
- *»Inverting«* (where necessary).



CAUTION **The debouncing time will be started each time the state of the input signal alternates.**

CAUTION **In addition to the debouncing time that can be set via software, there is always a hardware debouncing time (approx 12 ms) that cannot be turned of.**

DI-8P X

Name of the Assembly group:
DI-8P X1

Device Parameters of the Digital Inputs on DI-8P X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Nom Voltage	Nominal voltage of the digital inputs	24 V dc, 48 V dc, 60 V dc, 110/120 V dc, 230/240 V dc, 110/120 V ac, 230/240 V ac	110/120 V dc	[Device Para /Digital Inputs /DI-8P X1 /Group 1]
Inverting 1	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 1]
Debouncing Time 1	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 1]
Nom Voltage	Nominal voltage of the digital inputs	24 V dc, 48 V dc, 60 V dc, 110/120 V dc, 230/240 V dc, 110/120 V ac, 230/240 V ac	110/120 V dc	[Device Para /Digital Inputs /DI-8P X1 /Group 2]
Inverting 2	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Debouncing Time 2	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 2]
Nom Voltage	Nominal voltage of the digital inputs	24 V dc, 48 V dc, 60 V dc, 110/120 V dc, 230/240 V dc, 110/120 V ac, 230/240 V ac	110/120 V dc	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Inverting 3	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Debouncing Time 3	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Inverting 4	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Debouncing Time 4	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 5	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Debouncing Time 5	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Inverting 6	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Debouncing Time 6	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Inverting 7	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Debouncing Time 7	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted.	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 3]
Inverting 8	Inverting the input signals.	Inactive, Active	Inactive	[Device Para /Digital Inputs /DI-8P X1 /Group 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Debouncing Time 8	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, wipers will not be misinterpreted. 8	No Debouncing Time, 20 ms, 50 ms, 100 ms	20 ms	[Device Para /Digital Inputs /DI-8P X1 /Group 3]

Digital Inputs Output Signals on DI-8P X

Name	*Description*
DI 1	Signal: Digital Input
DI 2	Signal: Digital Input
DI 3	Signal: Digital Input
DI 4	Signal: Digital Input
DI 5	Signal: Digital Input
DI 6	Signal: Digital Input
DI 7	Signal: Digital Input
DI 8	Signal: Digital Input

Module: Trip Control (TripControl)

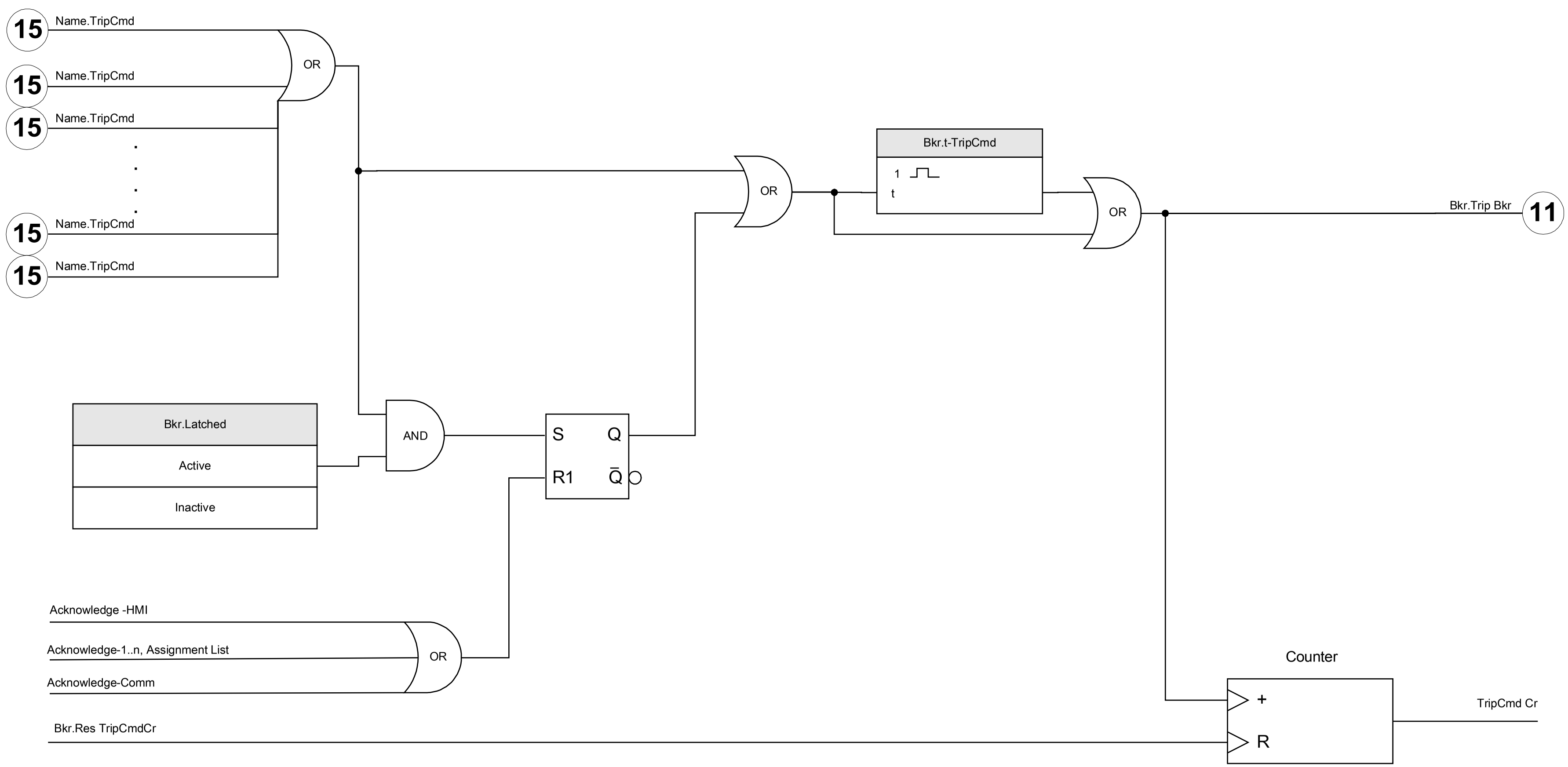
Bkr

The tripping commands of all protection modules are combined in the *»TripLogic«* module by an “OR” logic. The command for tripping can come from each of the protection modules, but the actual tripping command to the breaker is only given by the *»TripLogic«* module.

In addition to that, the User can set the minimum hold time of the tripping command within this module and define whether the tripping command is latched or not.

Bkr.Trip Bkr

Name =Each trip of an active, trip authorized protection module will lead to a general trip.



Direct Commands of the Trip Control Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack TripCmd	Acknowledge Trip Command	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Trip Control Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-TripCmd	Minimum hold time of the OPEN-command (Breaker, load break switch)	0.1 - 300.0s	0.1s	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
Latched	Defines whether the Relay Output will be Latched when it picks up.	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
Ack TripCmd	Acknowledge Trip Command	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
t-max-OPEN	Within this time the OPEN command has to be carried out by the breaker. Within this time the position indicators (check back signals) have to change from CLOSE to OPEN.	0.00 - 10.00s	0.10s	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
t-max-CLOSE	Within this time the CLOSE command has to be carried out by the breaker. Within this time the position indicators (check back signals) have to change from OPEN to CLOSE.	0.00 - 10.00s	0.10s	[Protection Para /Global Prot Para /Bkr Manager /Bkr]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
CinBkr-52a	The breaker is in CLOSE-position if the state of the assigned signal is true (52a).	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	DI-8P X1.DI 5	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
CinBkr-52b	The breaker is in OPEN-position if the state of the assigned signal is true (52b).	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	DI-8P X1.DI 6	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
Ex Manual CLOSE CMD	External manual breaker CLOSE command (NOT for AR!). The breaker was closed manually if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Switch Onto Fault (SOTF), e.g. as a trigger signal.	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
Manual OPEN	The breaker was switched off (OPEN) manually if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Cold Load Pickup (CLPU), e.g. as a trigger signal.	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ready	Breaker is ready for operation if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Auto Reclosure (AR), e.g. as a trigger signal.	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	-.-	[Protection Para /Global Prot Para /Bkr Manager /Bkr]

Trip Control Module Input States

Name	*Description*	*Assignment Via*
Acknow Sig-I	Module Input State: Acknowledgment Signal (only for automatic acknowledgment). Module input signal	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
CinBkr-52a-I	Position indicator/check-back signal of the Bkr (52a)	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
CinBkr-52b-I	Module Input State: Position indicator/check-back signal of the Bkr. (52b)	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
Ex Manual CLOSE CMD-I	Module Input State: External manual breaker CLOSE command (NOT for AR!)	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
Manual OPEN-I	Module Input State: Breaker was switched off (OPEN) manually.	[Protection Para /Global Prot Para /Bkr Manager /Bkr]
Ready-I	Module Input State: Breaker Ready	[Protection Para /Global Prot Para /Bkr Manager /Bkr]

Trip Control Module Signals (Output States)

Name	*Description*
TripCmd	Signal: Trip Command
Ack TripCmd	Signal: Acknowledge Trip Command
State	Signal: Breaker Position (0 = Indeterminate, 1 = OPEN, 2 = CLOSE, 3 = Disturbed)
Ready	Signal: Breaker is ready for operation.
Manual OPEN	Signal: Breaker was switched off manually.
Ex Manual CLOSE CMD	Signal: External manual breaker CLOSE command (NOT for AR!)
Pos OPEN	Signal: Breaker is in OPEN-Position
Pos CLOSE	Signal: Breaker is in CLOSE-Position
Pos Indeterm	Signal: Breaker is in Indeterminate Position

Name	*Description*
Pos Disturb	Signal: Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.

Relay Output Configuration

The State of the Relay Outputs can be checked within menu:

[Operations/Status Display/Name of the assembly group (e.g. RO-XX)]

The Relay Outputs can be configured within menu:

[Device Para/Relay Outputs/Name of the assembly group (e.g. RO-XX)]

Set the following parameters for each of the relay output contacts.

•Up to seven (7) signals from the »assignment list« (OR-connected).

The states of the module outputs and the signals (e.g. states of protective functions) can be assigned to the relay output contacts. The relay output contacts are "dry-type" contacts.

•Each of the assigned signals can be inverted.

•The (collective) state of the relay output contacts can be inverted.

•Each relay output contact can be set as *»Latched«* (Latched = active or inactive). A latched relay output contact will return to it's latched position after a loss of power to the protective device. A latched relay output contact will keep it´s position as long as it has not been reset and as long as the power supply feeds the protective relay. In the case of a loss of power to the protective device, the relays will return to the latched position once the power is restored to the protective device (latched = relay output contacts have a memory). A latched state of a relay output contact always needs to be reset after a power loss even if the assignments are taken away (if the assignments are reprogrammed).

•*Latched = inactive«*:
If the latching function is *»inactive«*, the relay output and, respectively, the relay output contact will adopt the state of those pickups that were assigned.

•*»Latched = active«:*
If the latching function is *»active«*, the state of the relay output and, respectively, the relay output contact that was set by the pickups will be stored (they have a memory that needs to be reset).

The relay output contact can only be acknowledged after reset of those signals that had initiated the setting of the relay and after expiration of the »*t-OFF delay«*.

•At signal changes, the minimal latching time (*»t-OFF delay«*) ensures that the relay will be maintained as picked-up or released for at least this period.

CAUTION

If the relay output contacts are configured as »Latched=*active«,* they will keep their position even if there is a power outage within the power supply of the protective device.

If the relay output contacts are configured as »Latched=active«, they will also retain their position even if they are reprogrammed in another way. This also applies if the relay output contacts are set to »Latched is set to in*active«*. Resetting a relay output contact that has latched a signal will always require an acknowledgement.

NOTICE

The *»System OK Relay«* (watchdog) cannot be configured.

Acknowledgment Options

Relay output contacts can be acknowledged:

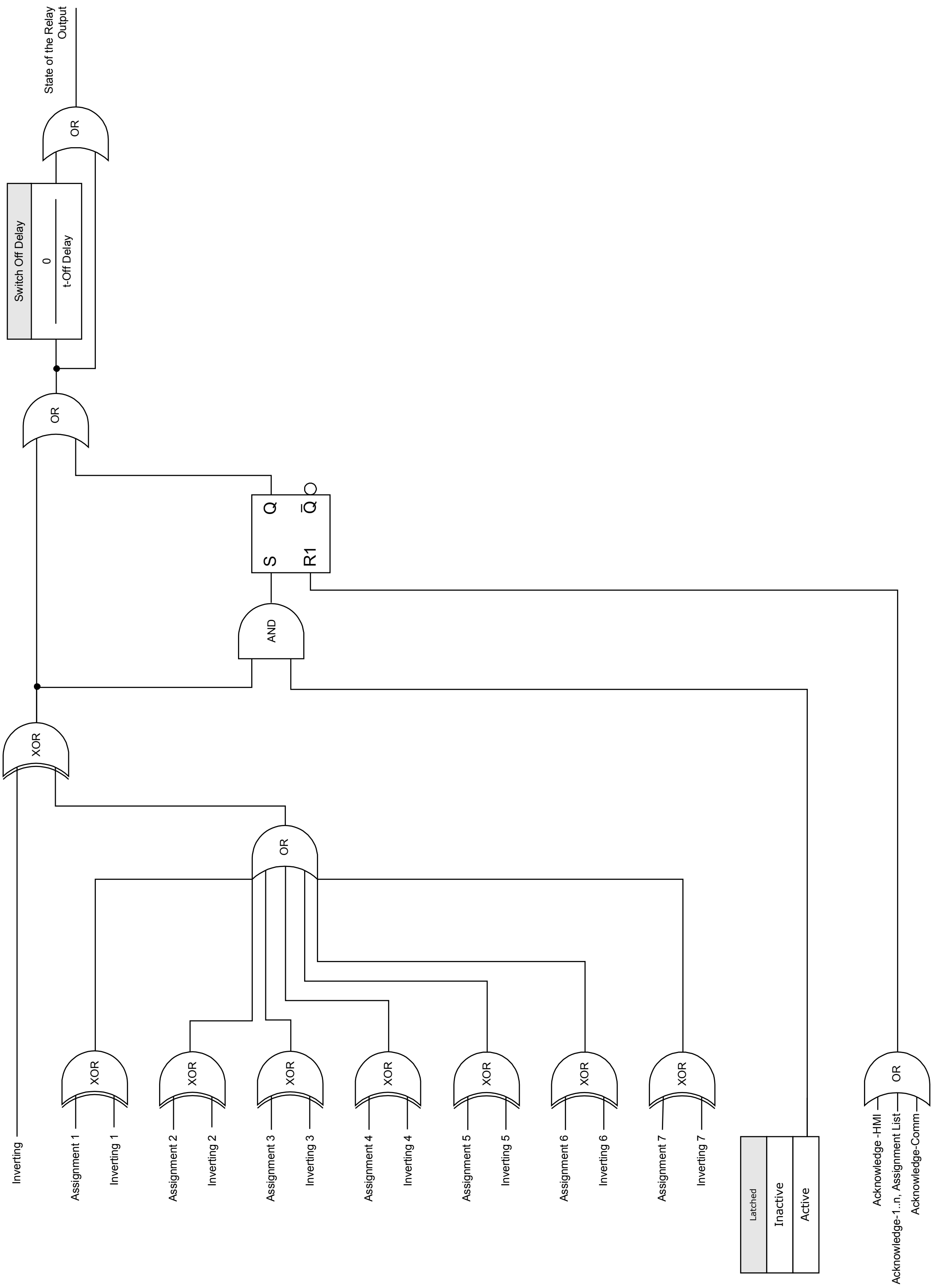
•Via the push-button »C« at the operating panel;

•If »*Latched is active«, e*ach relay output contact can be acknowledged by a signal (for example: It could be reset by the state of a digital input);

•Via the module »Ex Acknowledge« where all relay output contacts can be acknowledged at once if the signal for external acknowledgment that was selected from the »Assignment list« becomes true (e.g.: the state of a digital input); and

•Via Communication (Comm), all relay output contacts can be acknowledged at once.

WARNING **Relay output contacts can be set by force or disarmed (for commisioning support, please refer to the “Service/Disarming the Relay Output Contacts“ and “Service/Forcing the Relay Output Contacts“ sections).**



RO-4ZI X - Settings

RO-4Z X2

Direct Commands of RO-4ZI X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
DISARMED	This is the second step, after the "DISARMED Ctrl" has been activated, that is required to DISARM the relay outputs. This will DISARM those relay outputs that are currently not latched and that are not timing off. CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance. Only available if: DISARMED Ctrl = Active	Inactive, Active	Inactive	[Service /Test /DISARMED /RO-4Z X2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force all Outs	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state. Forcing all relay outputs of an entire assembly group has precedence to forcing a single relay output.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-4Z X2]
Force ZI RO	Signal: Forced Zone Interlocking OUT	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-4Z X2]
Force RO1	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-4Z X2]
Force RO2	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-4Z X2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force RO3	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-4Z X2]
Force RO4	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-4Z X2]

Global Protection Parameters of RO-4ZI X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.1s	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Assignment 1	Assignment	1..n, Assignment List	Bkr.TripCmd	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Assignment 1	Assignment	1..n, Assignment List	Prot.Pickup	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Assignment 1	Assignment	1..n, Assignment List	BF.Trip	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
DISARMED Ctrl	Enables and disables the disarming of the relay outputs. This is the first step of a two step process, to inhibit the operation or the relay outputs. Please refer to "DISARMED" for the second step.	Inactive, Active	Inactive	[Service /Test /DISARMED /RO-4Z X2]
Disarm Mode	CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance.	Permanent, Timeout	Permanent	[Service /Test /DISARMED /RO-4Z X2]
t-Timeout DISARM	The relays will be armed again after expiring of this time. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test /DISARMED /RO-4Z X2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force Mode	By means of this function the normal Relay Output States can be overwritten (forced) in case that the Relay Output is not in a disarmed state. The relays can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Permanent, Timeout	Permanent	[Service /Test /Force RO /RO-4Z X2]
t-Timeout Force	The Output State will be set by force for the duration of this time. That means, for the duration of this time, the Relay Output does not show the state of the signals that are assigned on it. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test /Force RO /RO-4Z X2]

Input States of RO-4ZI X

Name	*Description*	*Assignment Via*
RO1.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
RO1.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
RO1.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
RO1.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
RO1.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
RO1.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
RO1.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
Ack signal RO 3	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-4Z X2 /RO 1]
RO2.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]

Name	*Description*	*Assignment Via*
RO2.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
RO2.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
RO2.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
RO2.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
RO2.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
RO2.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
Ack signal RO 4	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-4Z X2 /RO 2]
RO3.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
RO3.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]

Name	*Description*	*Assignment Via*
RO3.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
RO3.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
RO3.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
RO3.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
RO3.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
Ack signal RO 5	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-4Z X2 /RO 3]
RO4.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
RO4.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
RO4.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]

Name	*Description*	*Assignment Via*
RO4.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
RO4.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
RO4.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
RO4.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]
Ack signal RO 6	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-4Z X2 /RO 4]

Signals of RO-4ZI X

Name	*Description*
ZI OUT	Signal: Zone Interlocking OUT
RO 1	Signal: Relay Output
RO 2	Signal: Relay Output
RO 3	Signal: Relay Output
RO 4	Signal: Relay Output
DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assined signals.

RO-6 X Settings

RO-6 X5

Direct Commands of RO-6 X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
DISARMED	This is the second step, after the "DISARMED Ctrl" has been activated, that is required to DISARM the relay outputs. This will DISARM those relay outputs that are currently not latched and that are not timing off. CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance. Only available if: DISARMED Ctrl = Active	Inactive, Active	Inactive	[Service /Test /DISARMED /RO-6 X5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force all Outs	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state. Forcing all relay outputs of an entire assembly group has precedence to forcing a single relay output.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-6 X5]
Force RO1	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-6 X5]
Force RO2	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-6 X5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force RO3	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-6 X5]
Force RO4	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-6 X5]
Force RO5	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-6 X5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force RO6	By means of this function the normal Relay Output State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force RO /RO-6 X5]

Device Parameters of RO-6 X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 2]

Parameter	Description	Setting Range	Default	Menu Path
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]

Parameter	Description	Setting Range	Default	Menu Path
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 4]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Latched	Defines whether the Relay Output will be latched when it picks up.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Acknowledgment	Acknowledgment Signal - An acknowledgment signal (that acknowledges the corresponding Relay Output) can be assigned to each Relay Output. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Inverting	Inverting of the Relay Output.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Inverting 6	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Relay Outputs /RO-6 X5 /RO 6]

Parameter	Description	Setting Range	Default	Menu Path
Inverting 7	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
DISARMED Ctrl	Enables and disables the disarming of the relay outputs. This is the first step of a two step process, to inhibit the operation or the relay outputs. Please refer to "DISARMED" for the second step.	Inactive, Active	Inactive	[Service /Test /DISARMED /RO-6 X5]
Disarm Mode	CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance.	Permanent, Timeout	Permanent	[Service /Test /DISARMED /RO-6 X5]
t-Timeout DISARM	The relays will be armed again after expiring of this time. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test /DISARMED /RO-6 X5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Force Mode	By means of this function the normal Relay Output States can be overwritten (forced) in case that the Relay Output is not in a disarmed state. The relays can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Permanent, Timeout	Permanent	[Service /Test /Force RO /RO-6 X5]
t-Timeout Force	The Output State will be set by force for the duration of this time. That means, for the duration of this time, the Relay Output does not show the state of the signals that are assigned on it. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test /Force RO /RO-6 X5]

Input States of RO-6 X

Name	*Description*	*Assignment Via*
RO1.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
RO1.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
RO1.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
RO1.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
RO1.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
RO1.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
RO1.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
Ack signal RO 1	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-6 X5 /RO 1]
RO2.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 2]

Name	*Description*	*Assignment Via*
RO2.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
RO2.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
RO2.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
RO2.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
RO2.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
RO2.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
Ack signal RO 2	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-6 X5 /RO 2]
RO3.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
RO3.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 3]

Name	*Description*	*Assignment Via*
RO3.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
RO3.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
RO3.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
RO3.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
RO3.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
Ack signal RO 3	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-6 X5 /RO 3]
RO4.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
RO4.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
RO4.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 4]

Name	*Description*	*Assignment Via*
RO4.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
RO4.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
RO4.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
RO4.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
Ack signal RO 4	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-6 X5 /RO 4]
RO5.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
RO5.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
RO5.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
RO5.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 5]

Name	*Description*	*Assignment Via*
RO5.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
RO5.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
RO5.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
Ack signal RO 5	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-6 X5 /RO 5]
RO6.1	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
RO6.2	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
RO6.3	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
RO6.4	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
RO6.5	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 6]

Name	*Description*	*Assignment Via*
RO6.6	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
RO6.7	Module Input State: Assignment	[Device Para /Relay Outputs /RO-6 X5 /RO 6]
Ack signal RO 6	Module Input State: Acknowledgment signal for the Relay Output. If latching is set to active, the Relay Output can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Relay Outputs /RO-6 X5 /RO 6]

Signals of RO-6 X

Name	*Description*
RO 1	Signal: Relay Output
RO 2	Signal: Relay Output
RO 3	Signal: Relay Output
RO 4	Signal: Relay Output
RO 5	Signal: Relay Output
RO 6	Signal: Relay Output
DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assined signals.

LED Configuration

The LEDs can be configured within menu:

[Device Para/LEDs/Group X]

CAUTION

Attention must be paid to insure that there are no overlapping functions due to double or multiple LED assignment of colors and flashing codes.

CAUTION

If LEDs are configured as »Latched=*active«,* they will keep (return to) their blink code and color even if there is a power outage within the power supply of the protective device.

If the LEDs are configured as »Latched=*active«,* they will also retain their blink code and color even if the LEDs are reprogrammed in another way. This also applies if the LEDs are set to »Latched = in*active«*. Resetting a LED that has latched a signal will always require an acknowledgement.

NOTICE

This chapter contains information on the LEDs that are placed on the left hand side of the display (Group A).

If your device is also equipped with LEDs on the right hand side of the display (Group B), the analog information in this chapter is valid. The only difference between "Group A" and "Group B" is within the menu paths.

Via the »INFO« push-button, it is always possible to display the current pickups and alarm texts that are assigned to an LED. Please refer to the *Navigation* section for a description of the »INFO« push-button functionality.

Set the following parameters for each LED.

• *»Latching (self holding function)«*: If *»Latching«* is set to *»Active«*, the state that is set by the pickups will be stored until it is reset. If *»Latching«* is set to *»Inactive«*, the LED always adopts the state of those pickups that were assigned.

• *»Acknowledgement«: S*ignal that will reset the LED.

• *»LED active color«*: LED lights up in this color when at least one of the allocated functions is valid (red, red-flashing, green, green flashing, off).

• *»LED inactive color«*: LED lights up in this color when none of the allocated functions is valid (red, red-flashing, green, green flashing, off).

• *»Assignment 1...n«* Apart from the *LED for System OK*, each LED can be assigned up to five functions (e.g. pickups) out of the »Assignment list«.

• *»Inverting an Assignment 1...n«:* This will invert the input signal.

Acknowledgment Options

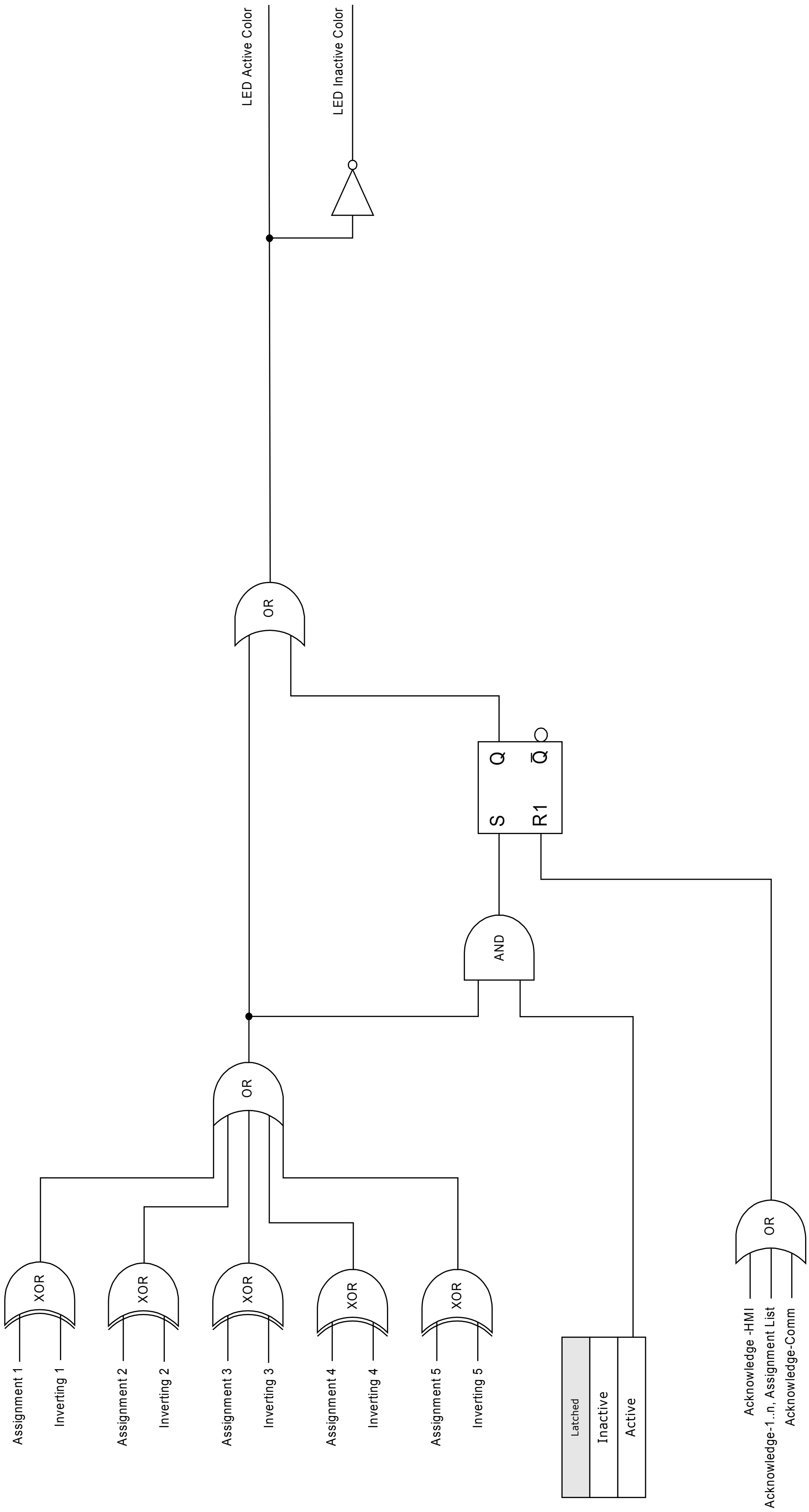
LEDs can be acknowledged by:

•The push-button »C« at the operating panel;

•A signal from the »LED Reset list« (e.g. digital inputs or communication signals) (If »*Latched* = *active*«);

•The »Ex Acknowledge« module - all LEDs can be acknowledged at once, if the signal for external acknowledgment becomes true (e.g.: the state of a digital input); and

•Communication (Comm) - all LEDs can be acknowledged at once.


LED Active Color
LED Inactive Color
OR
Q
Q̄
S
R1
AND
OR
XOR
XOR
XOR
XOR
XOR
OR
Assignment 1
Inverting 1
Assignment 2
Inverting 2
Assignment 3
Inverting 3
Assignment 4
Inverting 4
Assignment 5
Inverting 5
Latched
Inactive
Active
Acknowledge -HMI
Acknowledge-1..n, Assignment List
Acknowledge-Comm

The »System OK« LED

This LED flashes green while the device is booting. After booting is complete, the LED for *System OK* lights up in green signaling that the *protection* (function) is »*activated*«. If, however, in spite of successful booting, or after the third unsuccessful reboot caused by the self supervision module, the *System OK – LED* flashes in red or is solidly illuminated in red, please contact your Eaton Corporation Customer Service Representative (also see the Self Supervision section).

The System OK LED cannot be configured.

LED Settings

LEDs group A ,LEDs group B

Device Parameters of the LEDs

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Active LEDs group B: Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Dependency Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 1]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red LEDs group B: Green	[Device Para /LEDs /LEDs group A /LED 1]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 51P[1].TripCmd LEDs group B: Bkr.Pos OPEN	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 1]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Active LEDs group B: Inactive	[Device Para /LEDs /LEDs group A /LED 2]

Parameter	Description	Setting Range	Default	Menu Path
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	Red	[Device Para /LEDs /LEDs group A /LED 2]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 51X[1].TripCmd LEDs group B: Bkr.Pos CLOSE	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 51R[1].TripCmd LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 2]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	Active	[Device Para /LEDs /LEDs group A /LED 3]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 3]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	Red	[Device Para /LEDs /LEDs group A /LED 3]

Parameter	Description	Setting Range	Default	Menu Path
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 50P[1].TripCmd LEDs group B: 27M[1].TripCmd	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: -.- LEDs group B: 59M[1].TripCmd	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 3]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	Active	[Device Para /LEDs /LEDs group A /LED 4]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	Red	[Device Para /LEDs /LEDs group A /LED 4]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: 50X[1].TripCmd LEDs group B: 81[1].TripCmd	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: 50R[1].TripCmd LEDs group B: 81[3].TripCmd	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 3	Assignment	1..n, Assignment List	LEDs group A: -.- LEDs group B: 81[5].TripCmd	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 4]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Inactive LEDs group B: Active	[Device Para /LEDs /LEDs group A /LED 5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Red flash LEDs group B: Red	[Device Para /LEDs /LEDs group A /LED 5]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: Prot.Pickup LEDs group B: ZI.TripCmd	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 5]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	Active	[Device Para /LEDs /LEDs group A /LED 6]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	Red	[Device Para /LEDs /LEDs group A /LED 6]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: BF.Trip LEDs group B: LOP.LOP Blo	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 6]
Latched	Defines whether the LED will be latched when it picks up.	Inactive, Active	LEDs group A: Inactive LEDs group B: Active	[Device Para /LEDs /LEDs group A /LED 7]
Ack signal	Acknowledgment signal for the LED. If latching is set to active the LED can only be acknowledged if all signals that initiated the setting of the LED are no longer present. Only available if: Latched = Active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
LED Active Color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	Green, Red, Red flash, Green flash, -	LEDs group A: Green flash LEDs group B: Red	[Device Para /LEDs /LEDs group A /LED 7]
LED Inactive Color	The LED lights up in this color if the state of the OR-assignment of the signals is false.	Green, Red, Red flash, Green flash, -	-	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: Sys.Maint Mode Active LEDs group B: Prot.Trip	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 1	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 2	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 3	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 4	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 5	Inverting of the state of the assigned signal.	Inactive, Active	Inactive	[Device Para /LEDs /LEDs group A /LED 7]

LED Input States

Name	*Description*	*Assignment Via*
LED1.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 1]
Acknow Sig 1	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 1]
LED2.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]

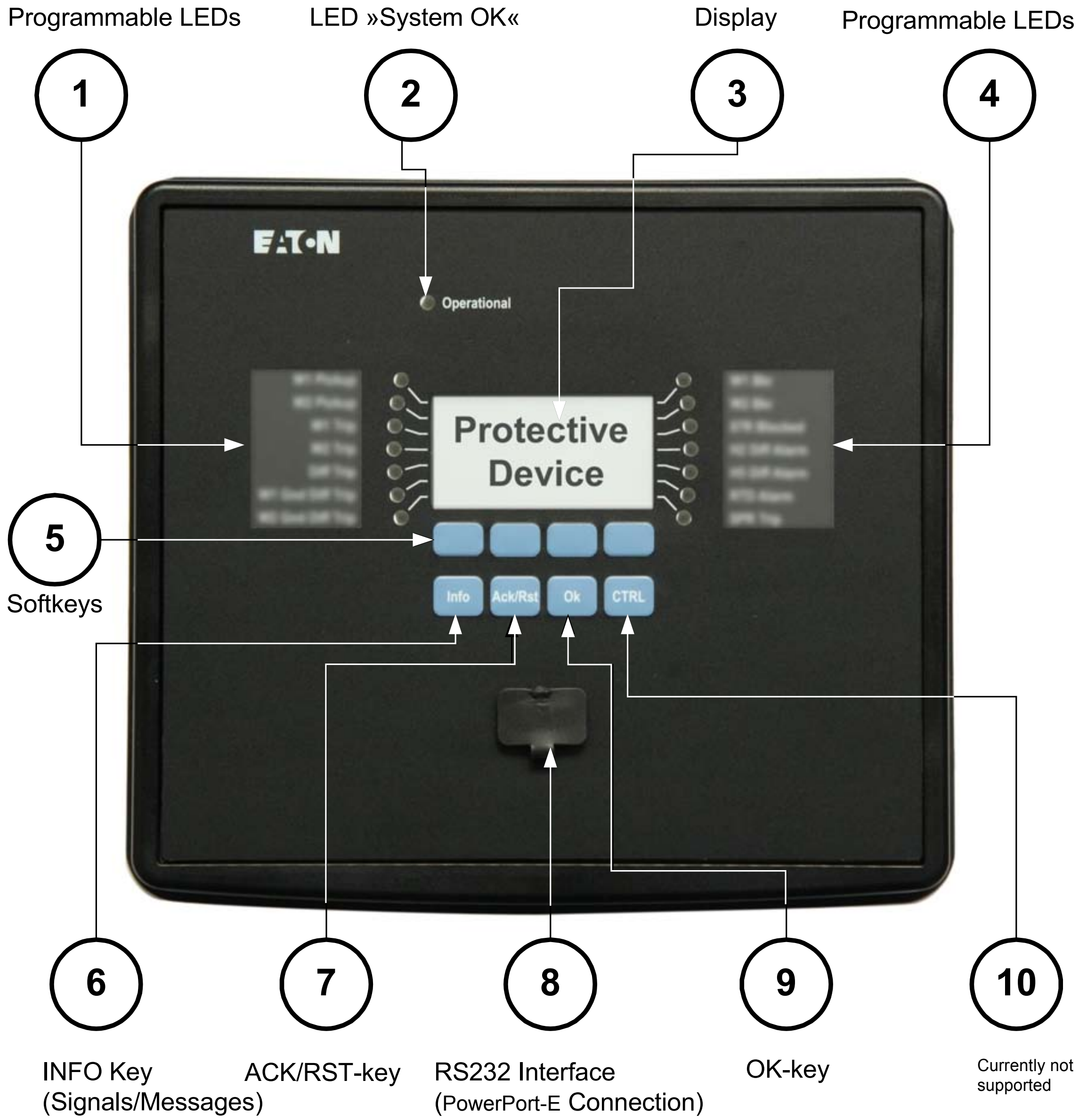
Name	*Description*	*Assignment Via*
LED2.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 2]
Acknow Sig 2	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 2]
LED3.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 3]
Acknow Sig 3	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 3]
LED4.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]

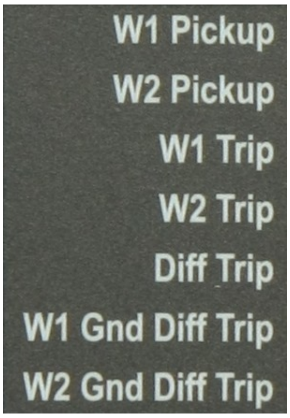
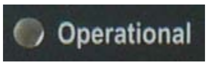
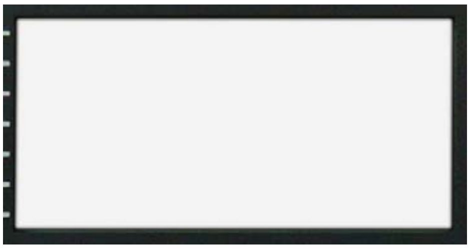
Name	*Description*	*Assignment Via*
LED4.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 4]
Acknow Sig 4	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 4]
LED5.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 5]

Name	*Description*	*Assignment Via*
Acknow Sig 5	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 5]
LED6.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 6]
Acknow Sig 6	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 6]
LED7.1	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.2	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.3	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]

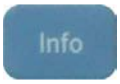
Name	*Description*	*Assignment Via*
LED7.4	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.5	Module Input State: LED	[Device Para /LEDs /LEDs group A /LED 7]
Acknow Sig 7	Module Input State: Acknowledgment Signal (only for automatic acknowledgment).	[Device Para /LEDs /LEDs group A /LED 7]

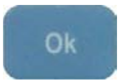
Front Panel


Programmable LEDs
LED »System OK«
Display
Programmable LEDs
1
2
3
4
Operational
Protective Device
5
Softkeys
Info
Ack/Rst
Ok
CTRL
6
7
8
9
10
INFO Key (Signals/Messages)
ACK/RST-key
RS232 Interface (PowerPort-E Connection)
OK-key
Currently not supported

Item	Graphic	Name	Description
1		Group A: Programmable LEDs	Basically, there are 14 programmable LEDs (7 on the left, 7 on the right side)provided for User to configure. The choice for each programmable LED can be any signal from the global assignment list, which includes all internal operation states of each function activated. Based on the application need, up to 14 (but not necessarily all) programmable LEDs can be activated. By properly configuring some or all 14 LEDs, the User will be able to view the relay's overall operation and some critical information immediately and intuitively without having to access any menu.
2		LED »System OK«	Should the LED »System OK« flash red during operation, contact Customer Support immediately.
3		Display	Via the display, the User can view operational data and edit the parameters.

Item	Graphic	Name	Description
4		Group B: Programmable LEDs	Basically, there are 14 programmable LEDs (7 on the left, 7 on the right side)provided for User to configure. The choice for each programmable LED can be any signal from the global assignment list, which includes all internal operation states of each function activated. Based on the application need, up to 14 (but not necessarily all) programmable LEDs can be activated. By properly configuring some or all 14 LEDs, the User will be able to view the relay's overall operation and some critical information immediately and intuitively without having to access any menu.
5		Softkeys	The function of the »SOFTKEYS« changes. Their active functions appear on the bottom line of the display. Possible functions are: • Navigation; • Parameter decrement/increment; • Scrolling up/down a menu page; • Moving to a digit; and • Change into the parameter setting mode »Wrench Symbol«.

Item	Graphic	Name	Description
6		INFO Key (Signals/Messages)	Looking through the present LED assignment. The Direct Select key can be activated at any time. If the INFO key is actuated again, the User will leave the LED menu. Here only the first assignments of the LEDs will be shown. Every three seconds the »SOFTKEYs« will be shown (flashing). *Displaying the Multiple Assignments* If the INFO key is pressed, only the first assignments of any LED is shown. Every three seconds the »SOFTKEYs« will be shown (flashing). If there is more than one signal assigned to an LED (indicated by three dots), the User can check the state of the multiple assignments by proceeding as follows. In order to show all (multiple) assignments, select an LED by means of the »SOFTKEYs« »up« and »down«. Via the »Softkey« »right«, call up a sub-menu of this LED that gives the User detailed information on the state of all signals assigned to this LED. An arrow symbol points to the LED whose assignments are currently displayed. Via the »SOFTKEYs« »up« and »down«, the User can call up the next / previous LED. In order to leave the LED menu, press the »SOFTKEY« »left« multiple times.

Item	Graphic	Name	Description
7		»ACK/RST- Key«	Used to abort changes and to acknowledge messages as well as resetting counters. In order to reset, press the Softkey »Wrench« and enter the password. The User can exit the reset menu by pressing the Softkey »Arrow-left«
8		RS232 Interface (PowerPort-E Connection)	Connection to the computer/software PowerPort-E is done via the RS232 interface.
9		»OK Key«	When using the »OK« key, parameter changes are temporarily stored. If the »OK« key is pressed again, those changes are stored indefinitely.
10		»CTRL Key«	Currently not supported.

Basic Menu Control

The graphic user interface is equivalent to a hierarchical structured menu tree. For access to the individual sub-menus, the »SOFTKEYS«/Navigation Keys are used. The function of the »SOFTKEYS« can be found near the bottom of the display.

Softkey	***Description***
	• Via »SOFTKEY« »Up«, the User will be taken to the prior menu point/one parameter up by scrolling upwards.
	• Via »SOFTKEY« »Left«, the User will be taken one step back.
	• Via »SOFTKEY« »Down«, the User will be taken to the next menu point/one parameter down by scrolling downwards.
	• Via »SOFTKEY« »Right«, the User will be taken to a sub-menu.
	• Via »SOFTKEY« »Top of List«, the User will be taken directly to the top of a list.
	• Via »SOFTKEY« »Bottom of List«, the User will be taken directly to the end of a list.
	• Via »SOFTKEY« »+«, the related digit will be incremented. (Continuous pressure -> fast).
	• Via »SOFTKEY« »-«, the related digit will be decremented. (Continuous pressure -> fast)
	• Via »SOFTKEY« »Left«, the User will be taken one digit to the left.
	• Via »SOFTKEY« »Right«, the User will be taken one digit to the right.
	• Via »SOFTKEY« »Parameter Setting«, the User will call up the parameter setting mode.
	• Via »SOFTKEY« »Delete«, data will be deleted.

In order to return to the main menu, just keep pressing the Softkey »Arrow-Left« until you arrive at the »Main Menu».

PowerPort-E Keyboard Commands

The User can control PowerPort-E alternatively by means of keyboard commands (instead of the mouse).

Key	*Description*
↑	Move up within the navigation tree or parameter list.
↓	Move down within the navigation tree or parameter list.
←	Collapse the tree item or select a folder on a higher level.
→	Expands the tree item or selects a sub-folder.
Numpad +	Expands the tree item.
Numpad -	Collapses the tree item.
Home	Moves to the top of the active window.
End	Moves to the bottom of the active window.
Ctrl+O	Opens the file opening dialog. Allows browsing through the file system for an existing device file.
Ctrl+N	Creates a new parameter file by means of a template.
Ctrl+S	Saves the actual loaded parameter file.
F1	Displays the on-line help information.
F2	Loads device data.
F5	Reloads the displayed data of a device.
Ctrl+F5	Enables the automatic refresh.
Ctrl+Shift+T	Moves back to the navigation window.
Ctrl+F6	Walks through the tabular forms (detail windows).
Page ↑	Moves to the previous value (parameter setting).
Page ↓	Moves to the next value (parameter setting).

PowerPort-E

PowerPort-E is software that is used to configure a device and read data from a device. *PowerPort-E* provides the following:

•Menu-controlled parameter setting including validity checks;
•Off-line configuration of all relay types;
•Reading and evaluation of statistical data and measuring values;
•Commissioning Support (Forcing Relays, Disarming Relays);
•Display of the device status; and
•Fault analysis via event and fault recorder.

Installation of PowerPort-E

NOTICE **Port 52152 must not be blocked by a Firewall. Otherwise the connection will be blocked.**

NOTICE **If the Windows Vista User Access Control pops up while installing *PowerPort-E*, please "Allow" all installation requirements concerning *PowerPort-E*.**

System Requirements: Windows 2000, Windows XP, or Windows Vista).

To install *PowerPort-E*:

•Double-click on the installation file with the left mouse button.

•Confirm by pressing the »Continue« button in the INFO frame.

•Select an installation path or confirm the standard installation path by mouse click on the »Continue« button.

•Confirm the entry for the suggested installation folder by mouse click on the »Continue« button.

•Start the installation process by mouse click on the »Install« button.

•Finish the installation procedure by mouse click on the »Complete« button.

If the suggested installation folder was chosen in the procedure above, the User can now call up the program via

[Start > Programs > Eaton Relays> PowerPort-E].

Un-installing PowerPort-E

Via the [Start>System Control >Software] menu, the *PowerPort-E* application can be uninstalled from the computer.

Setting up the Serial Connection PC - Device

Set Up a Connection Via Serial Interface Under Windows 2000

After installation of the software, the »Connection PC/Notebook to the Device« has to be initially configured so that the User is able to read device data or re-write them into the device by means of the *PowerPort-E application.*

NOTICE **To connect the device to the User's PC/notebook, a special null modem cable is needed (no serial cable!- -please refer to the section »Null Modem Cable«).**

NOTICE **If the PC/notebook does not have a serial interface, the User will need a special *USB-to-serial-adapter.* If the *USB-to-serial-adapter* is correctly installed, communication with the device can be established using the CD provided (see the next section).**

NOTICE **The connection of the PC/notebook to the device MUST NOT be protected/encrypted via a smartcard.**

If the network connection wizard asks to encrypt the connection via a smartcard or not, please choose »Do not use the smartcard«.

Setting Up/Configuring the Connection

- Connect the PC/notebook with the device via a null modem cable.
- Start the *PowerPort-E* application.
- Select the menu point »Device Connection« in the »Settings« menu.
- Click on »Serial Connection«.
- Click the »Settings« button.
- When initially setting up the connection, a dialog window appears with the information that, so far, a direct connection with your protection device has not been established. Click on »Yes«.
- If, to this point, a location has not been set up on your PC, your location information has to be put in. Confirm the pop-up window »Telephone and Modem Options« with »OK«.
- The Windows network connection assistant appears after the location information is set up. Select the connection type »Establish direct connection to another computer«.
- Select the serial interface (COM-Port) where the device shall be connected.
- Select »To be used for all users« in the »Availability of the connection« window.
- Do not change the connection name appearing in window »Name of the connection« and click the button »Complete«.
- Finally, you arrive again in the window »Device Installation« from where you started establishing the connection. Confirm the adjustments by clicking the »OK« button.

NOTICE

Due to a problem in Windows 2000, it is possible that the automatically made communication settings are not correctly adopted. In order to overcome this problem, proceed as follows after setting up the serial connection.

- **Select the menu point »Device Connection« in the »Settings« menu.**
- **Select »Serial Connection«.**
- **Click on the »Settings« button.**
- **Change the register card to »General«.**
- **Ensure that »Communication cable between two computers Com X« is selected in the »Drop Down Menu«. X = the interface number where the User has connected the null modem cable.**
- **Click the »Configure« button.**
- **Ensure that the »Hardware Flowing Control« is activated.**
- **Ensure that a baud rate *»115200«* is selected.**

Set Up a Serial Connection Via Serial Interface Under Windows XP

After installation of the software, the »Connection PC/Notebook to the Device« has to be initially configured so that the User is able to read device data or re-write them into the device by means of the *PowerPort-E application.*

NOTICE

To connect the device to the User's PC/notebook, a special null modem cable is needed (no serial cable!- -please refer to the section »Null Modem Cable«).

NOTICE

If the PC/notebook does not have a serial interface, the User will need a special *USB-to-serial-adapter.* If the *USB-to-serial-adapter* is correctly installed, communication with the device can be established using the CD provided (see the next section).

Setting Up/Configuring the Connection

- Connect your PC/notebook with the device via a null modem cable.
- Start the *PowerPort-E application*.
- Select the menu point »Device Connection« in the »Settings« menu.
- Click on »Serial Connection«.
- Click the »Settings« button.
- When initially setting up the connection, a dialog window appears with the information that, so far, a direct connection with your protection device has not been established. Click on »Yes«.
- If, to this point, a location has not been set up on your PC, your location information has to be put in. Confirm the following pop-up window »Telephone and Modem Options« by selecting »OK«.
- The Windows network connection assistant appears after the location information is set up. Select the connection type »Establish direct connection to another computer«.
- Select the serial interface (COM-Port) where the device will be connected.
- Select »To be used for all users« in the »Availability of the connection« window.
- Do not change the connection name appearing in the »Name of the connection« window and click the »Complete« button.
- Finally, you arrive again in the »Device Installation« window where you started establishing the connection. Confirm the adjustments by clicking the »OK« button.

Parameter Setting and Evaluation via Serial/RS232

Set Up a Serial Connection Via Serial Interface Under Windows Vista

Establishing the connection between *PowerPort-E* and the device is a three step procedure:

1. Installing *PowerPort-E* (the application itself);
2. Installing a (virtual) modem (that is a precondition for TCP/IP communication via a null modem cable)/ (to be done within the control panel); and
3. Establishing a network connection between *PowerPort-E* and the device (to be done within PowerPort-E).

1. Installation of PowerPort-E (the application itself).

Refer to the “Installation of PowerPort-E” (earlier in this section).

2. Installation of the (Virtual) Modem.

•Call up the »Control Panel«.

•Choose »Hardware & Sound«.

•Choose »Phone & Modem Options«.

•Go to the »Modem« tab.

•Click on the »Add« button

•A new window »Install new modem**«** pops up.

•Set the check box »Don´t detect my modem**«.**

•Choose »I will select from list«.

•Click on the »Next« button.

•Choose the correct COM Port**.**

•Click on the »Next« button.

•Select »Computer cable between two computers**«.**

•Click on the »Properties« button.

•Go to the »General« tab.

•Click on the »Change Settings« button.

•Go to the »Modem« tab.

•Set within the Drop-Down Menu the correct **baud rate = 115200**

•Click on the »OK« button.

•Click on the »OK« button again.

•The User will now have to reboot the computer.

3. Establishing a Network Connection Between PowerPort-E and the Device.

•Connect the device to the PC/notebook via a correct null Modem-Cable.

•Run *PowerPort-E*.

•Call up »Device Connection« within the »Device Connection« menu.

•Click on the »Settings« button.

•A wizard will pop up asking you »How do you want to connect**«**.

•Choose »Dial-up«.

•The Telephone number must not be empty. Please enter any number (e.g.: 1).

•**Do not enter a User name and password**

•Click on the »OK« button.

Calling Up Web Site While Connected to a Device

In principle, it is possible to call up web sites *while* there is an active connection to the device.

If your computer has no direct connection to the Internet, that means that it is placed behind a proxy server. In certain circumstances, the device connection has to be modified. The device connection has to be provided with the proxy settings.

Internet Explorer

For each connection, the proxy settings have to be set manually. Please proceed as follows.

•Start your *Internet Explorer.*

•Call up the »Tools« menu.

•Call up the »Internet options« menu.

•Call up the »Connections« tab.

•Left click on the »Settings« button on the right of the »Device-Connection«.

•Set the check box »Use Proxy Server for this connection«.

•Enter the proxy settings that are available from your network administrator.

•Confirm the settings by pressing »OK«.

Firefox

The proxy settings are centrally managed, so there is no need to modify any settings.

Establishing the Serial Connection Via a USB-/RS232-Adapter

If your PC/notebook does not have an RS-232 interface, an *USB-/RS232-Adapter*+Null *Modem Cable can be used*.

NOTICE

Only an adapter approved by Eaton Corporation may be used. First install the adapter (with the related driver that you can find on the CD) and then establish the connection (*PowerPort-E => Device*). The adapters must support very high speed data transfer.

Set-up a Connection via Ethernet - TCP/IP

NOTICE **Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).**

Contact your IT administrator in order to establish the network connection.

Part 1: Set the TCP/IP Parameters at the panel (Device)

Call up the menu *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

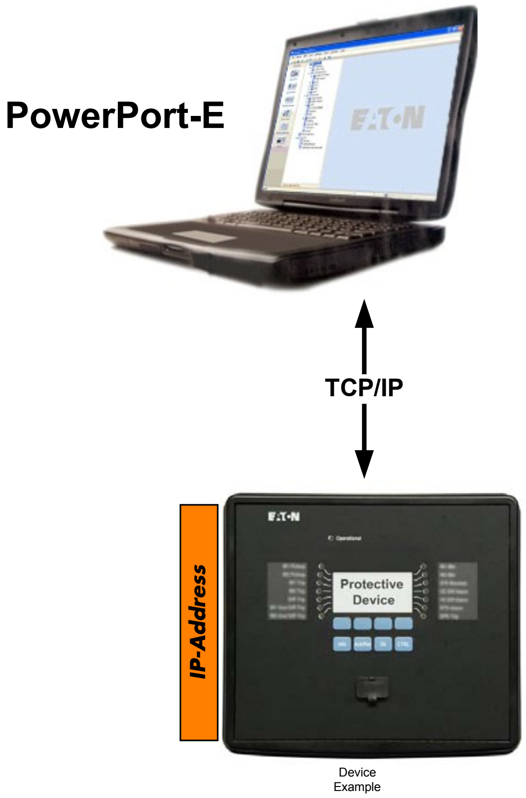
•TCP/IP address

•Subnet mask

•Gateway

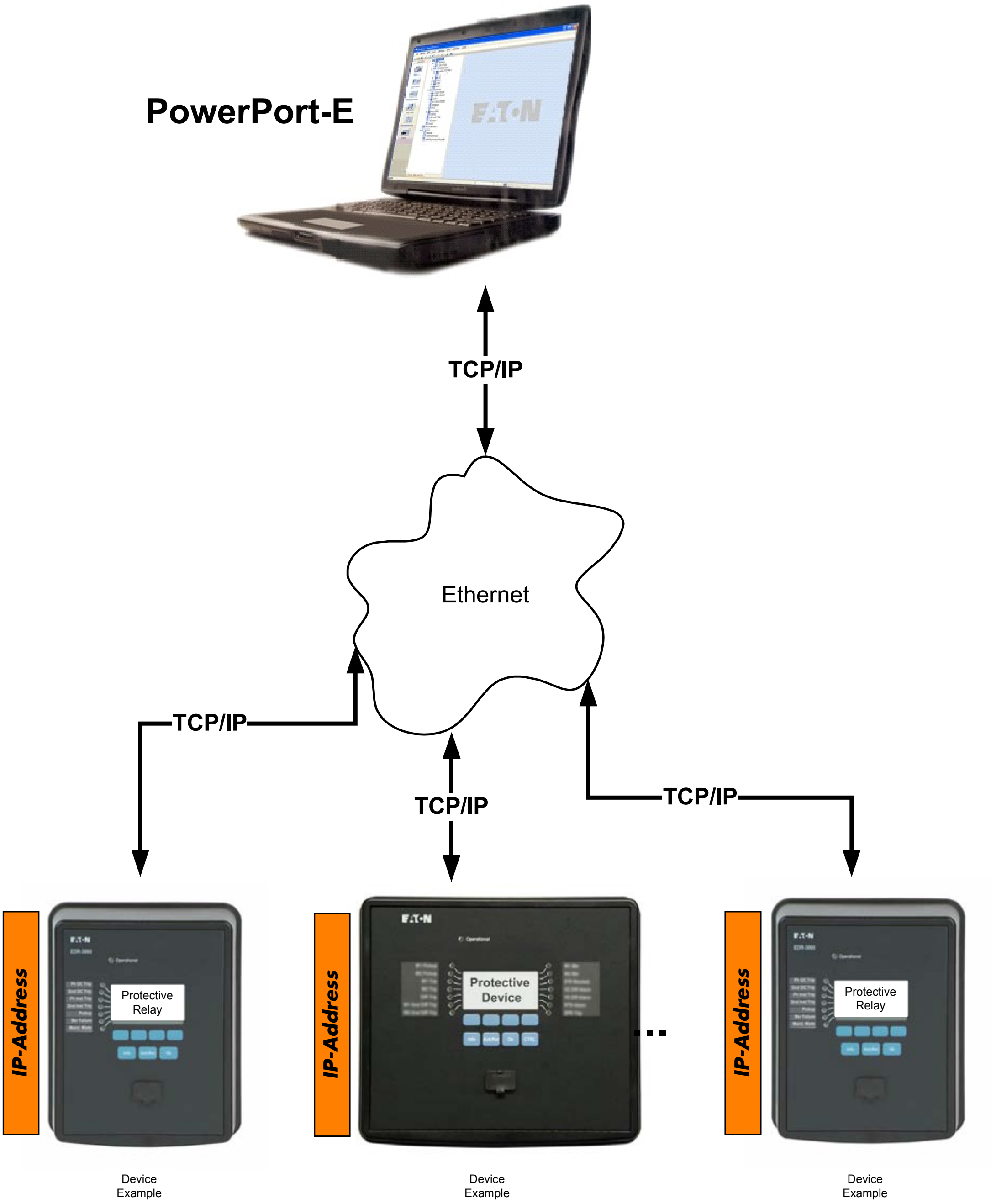
Part 2: Setting the IP address within PowerPort-E

- Call up the menu Settings/Device Connection within PowerPort-E.
- Set radio button Network Connection.
- Enter the IP-Address of the device that should be connected.



Parameter Setting and Evaluation via TCP/IP

Or:



Parameter Setting and Evaluation via TCP/IP

Set-up a Connection via Modbus Tunnel

NOTICE **Establishing a connection via a Gateway (TCP/IP)/Modbus RTU to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).**

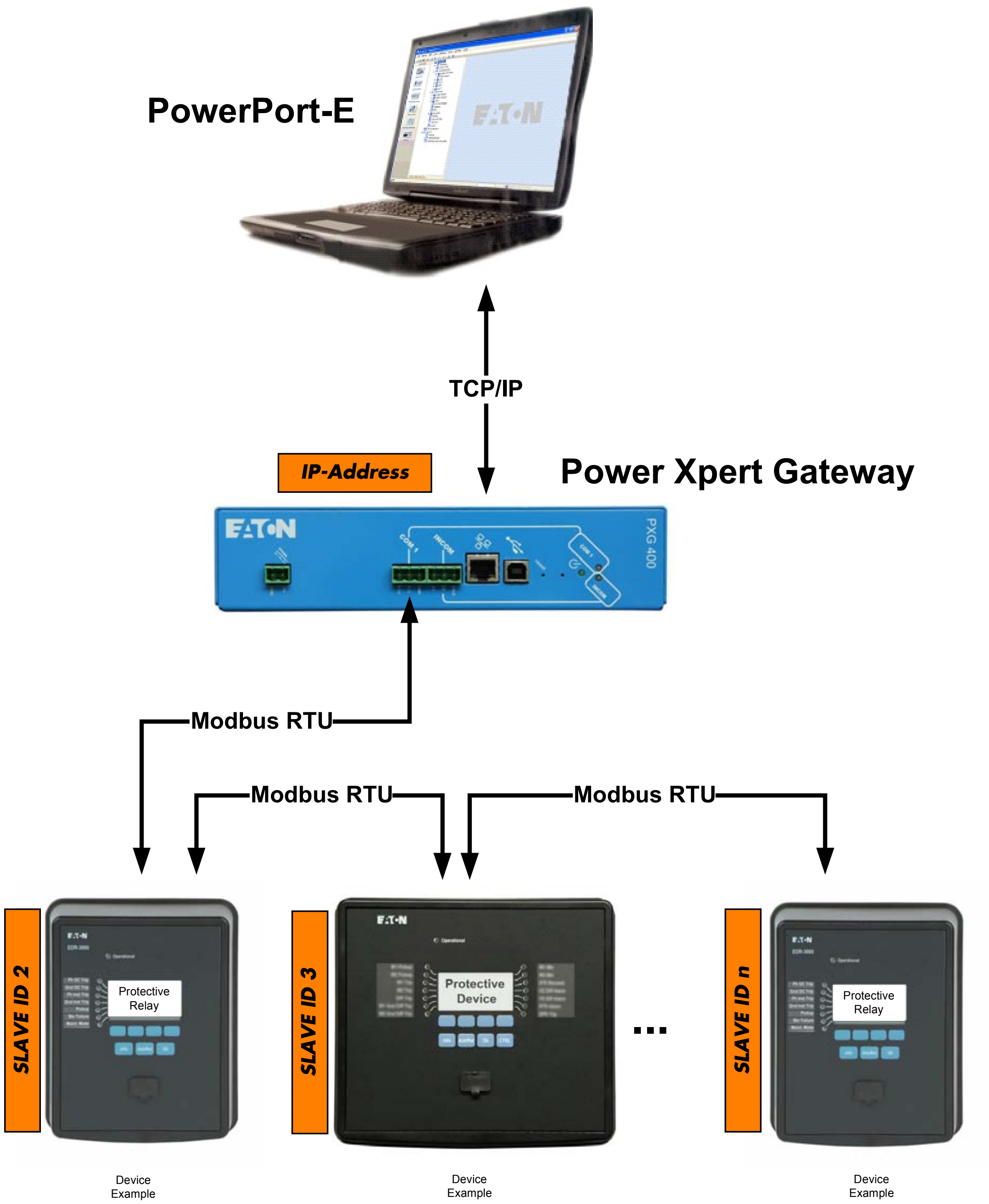
Contact your IT administrator in order to establish the network connection.

Part 1: If you don´t know the Slave ID of the device that should be connected via Modbus Tunnel, it can be read out at the device.

Call up the menu *»Device parameter/Modbus«* at the HMI (panel) and read out the Slave ID:

Part 2: Setting the IP address of the gateway and the Slave ID of the device that is to be connected via Modbus tunnel using PowerPort-E

- Call up the menu Settings/Device Connection within PowerPort-E.
- Set radio button Modbus TCP Gateway.
- Enter the IP-Address of the device that should be connected.
- Enter the Slave ID of the device.



Parameter Setting and Evaluation via Modbus Tunnel

PowerPort-E Troubleshooting

•Make sure that the Windows service *Telephony* is started. In [Start>System Control >Administration >Services] the service »Telephony« must be visible and must have been started. If not, the service has to be started.

•For establishing the connection, the User needs to have sufficient rights (administration rights).

•If a firewall is installed on your computer, TCP/IP port 52152 must have been released.

•If your computer does not have a serial interface, the User needs a *USB-to-serial-adapter*, approved by Eaton Corporation. This adapter has to be properly installed.

•Ensure that a null modem cable is used (a standard serial cable without control wires does not enable communication).

NOTICE

If a serial interface connection can not be established, and the User is running a Windows XP Operating System, the following may be the cause:

If a serial interface was selected in the connection assistant, it may be that this is not entered correctly in the dial-up network due to a bug in the Windows operating system. Your attention is drawn to this problem by the operational software and the error message »Warning, invalid connection setting« will be shown.

To solve this problem, you need administration rights.

Please proceed as follows.

- **Select the menu item »Device Connection« in the »Settings« menu.**
- **Select »Serial Connection«.**
- **Click the »Settings« button.**
- **Change the register card to »General«.**
- **Ensure that »Communication cable between two computers (Com X)« is selected in the Drop Down menu. »X« = the interface number where the null modem cable is connected.**

NOTICE

If the message »Warning, invalid connection settings« appears during establishment of the connection, it indicates that the connection adjustments chosen are not correct.

If this warning is displayed, the User may respond as follows.

»Yes«: (to set up a completely new connection).
By selecting »Yes«, all adjustments are canceled and the connection assistant is opened again for renewed adjustment of the connection to the device.

This procedure is advisable in case basic adjustments cannot be modified via the characteristics dialog (e.g.: if a new additional serial interface has been installed on the system).

»No«: (to modify the existing dial-up network entry).
Selecting »No« opens the dialog for characteristics of the connection settings. During the dialog, it is possible to correct invalid settings (e.g.: the recommended baud rate).

»Cancel«:
The warning is ignored and the connection adjustments remain as they are set. This procedure is accepted for a limited time, but the User is required to establish a correct connection at a later time.

PowerPort-E Persistent Connection Problems

In the case of persistent connection problems, the User should remove all connection settings and establish them again. In order to remove all connection settings, please proceed as follows.

1. *Remove the Settings for the Dial-up Network*

•Close PowerPort-E.

•Call up the »Control Panel«.

•Choose »Network & Internet«.

•On the left side, click on »Manage Network Connections«.

•Right click on »"Protective Device Name" Direct Connection«.

•Choose »Delete« from the shortcut menu.

•Click on the »OK« button.

2. *Remove the (Virtual) Modem*

•Call up the »Control Panel«.

•Choose »Hardware & Sound«.

•Choose »Phone & Modem Options«.

•Go to the »Modem« tab.

•Click on the correct (in case there is more than one) entry »Connection cable between two computers«.

•Click on the »Remove« button.

Loading of Device Data When Using PowerPort-E

•Start the *PowerPort-E application.*

•Make sure the connection has been established properly.

•Connect your PC with the device via a null *modem cable*.

•Select »Receiving Data From The Device« in the »Device« menu.

Restoring Device Data When Using PowerPort-E

WARNING

By selecting the »Transfer only modified parameters into the device« button only modified parameters are transmitted into the device.

Parameter modifications are indicated by a red "star symbol" in front of the parameter.

The star symbol (in the device tree window) indicates that parameters in the opened file (within PowerPort-E) differ from parameters stored on your local hard disk.

By selecting the »Transfer only modified parameters into the device« button, the User can transmit all parameters that are marked by this symbol.

If a parameter file is saved on the local hard drive, these parameters are no longer classified to be modified and cannot be transmitted via the »Transfer only modified parameters into the device« button.

In case the User has loaded and modified a parameter file from the device and saved it to the local hard drive without transferring the parameters into the device beforehand, the User cannot use the »Transfer only modified parameters into the device« button. In this case, use the »Transfer all parameters into the device« button.

NOTICE

The »Transfer only modified parameters into the device« button only works if modified parameters are available in the *PowerPort-E*.

In contrast, all parameters of the device are transferred when the »Transfer all parameters into the device« button is pressed (provided all device parameters are valid).

•In order to (re-)transfer changed parameters into the device, select »Transfer all parameters into the device« in the »Device« menu.

•Confirm the safety inquiry »Shall the parameters be overwritten into the device?«.

•Enter the password for setting parameters in the pop-up window.
•
•Thereafter, the changed data is transferred to the device and adopted.

•Confirm the inquiry »Parameters successfully updated?«. It is recommended to save the parameters into a local file on your hard drive. Confirm »Shall The Data Be Saved Locally?"« with »Yes« (recommended). Select a suitable folder on the hard disk.

•Confirm the chosen folder by clicking »Save«.

•The changed parameter data are now saved in the chosen folder.

Backup and Documentation When Using PowerPort-E

How to Save Device Data on a PC

Click on »Save as ...« in the »File« menu. Specify a name, choose a folder on the hard disk, and save the device data accordingly.

Printing of Device Data When Using PowerPort-E (Setting List)

The »Printing« menu offers the following options:

•Printer settings;
•Page preview;
•Printing; and
•Exporting the selected print range into a "txt" file.

The printing menu of the *PowerPort-E* software offers different types of printing ranges.

•*Printing of the complete parameter tree:*
All values and parameters of the present parameter file are printed.

•*Printing of the displayed working window:*
Only the data shown on the relevant working window are printed (i.e.: this applies, if at least one window is opened).

•*Printing of all opened working windows:*
The data shown on all windows are printed (i.e.: this applies only if more than one window is opened).

•*Printing of the device parameter tree as from a shown position on:*
All data and parameters of the device parameter tree are printed as from the position/marking in the navigation window. Below this selection, the complete name of the marking is additionally displayed.

Exporting Data as a “txt” File Via PowerPort-E

Within the print menu [File>Print], the User can choose »Export into File« in order to export the device data into a “txt” file.

NOTICE

When exporting data, only the actual selected printing range will be exported into a “txt” file. That means that if the User has chosen the “Complete device parameter tree” printing range, then the “Complete device parameter tree” will be exported. But, if the User has chosen “Actual working window” printing range, only that range of data will be exported.

This is the only method available to export data via PowerPort-E.

NOTICE

If the User exports a “txt” file, the content of this file is encoded as Unicode. That means that, if the User wants to edit this file, the application must support Unicode encoded files (e.g.: Microsoft Office 2003 or higher).

Off-line Device Planning Via PowerPort-E

NOTICE

In order to be able to transmit a parameter file (e.g.: created off-line) into the device, the following information must be located:

- **Type code (written on the top of the device/type label); and**
- **Version of the device model (can be found in menu [Device Parameters\Version].**

The *PowerPort-E* application also enables the User to create a configuration/parameter file off-line using a "Device Model". The advantage of using a device model is that the User can pre-configure a device by setting parameters in advance.

The User can also read the parameter file out of the device, further process it off-line (e.g.: from the office) and finally re-transfer it to the device.

The User can either:

•Load an existing parameter file from a device (please refer to the Section "Loading Device Data When Using PowerPort-E");

•Create a new parameter file (see below); or

•Open a locally saved parameter file (backup).

In order to create a new device/parameter file by way of a device template off-line.

•In order to create a new off-line parameter file, select »Create new parameter file« within the »File« menu.

•A working window pops- up. Please make sure that you select the right device type with the correct version and configuration.

•Finally click on »Apply«.

•In order to save the device configuration, select »Save« out of the »File« menu.

•Within the »Modify Device Configuration (Typecode)« menu, the User can modify the device configuration or simply find out the type code of the current selection.

If the User wants to transfer the parameter file into a device, please refer to Section "Restoring Device Data When using PowerPort-E".

Measuring Values

Read Out Measured Values

In the »Operation/Measured Values« menu, both measured and calculated values can be viewed. The measured values are ordered by »Standard values« and »Special values« (depending on the type of device).

Read Out of Measured Values Via PowerPort-E

•If *PowerPort-E* is not running, please start the application.

•If the device data have not been loaded, select »Receive Data From The Device« from the »Device« menu.

•Double click on the »Operation« icon in the navigation tree.

•Double click on the »Measured Values« icon within the »Operation« navigation tree.

•Double click the »Standard Values« or »Special values« within the »Measured values« tree.

•The measured and calculated values are now shown in tabular form in the window.

NOTICE **To have the measuring data read in a cyclic manner, select »Auto refresh« in the »View« menu. The measured values are read out about every two seconds.**

Current - Measured Values

If the device is not equipped with an voltage measuring card the first measuring input on the first current measuring card (slot with the lowest number) will be used as the reference angle (»*IA«).*

Angle IA	Measured Value (Calculated): Angle of Phasor IA	[Operation /Measured Values /Current]
Angle IB	Measured Value (Calculated): Angle of Phasor phi IB	[Operation /Measured Values /Current]
Angle IC	Measured Value (Calculated): Angle of Phasor phi IC	[Operation /Measured Values /Current]
Angle IX meas	Measured Value: Angle of Phasor IX meas	[Operation /Measured Values /Current]
Angle IR calc	Measured Value (Calculated): Angle of Phasor IR calc	[Operation /Measured Values /Current]

Angle I0	Measured Value (calculated): Angle of Zero Sequence System	[Operation /Measured Values /Current]
Angle I1	Measured Value (calculated): Angle of Positive Sequence System	[Operation /Measured Values /Current]
Angle I2	Measured value (calculated): Angle of Negative Sequence System	[Operation /Measured Values /Current]
I0 Fund.	Measured value (calculated): Zero current (Fundamental)	[Operation /Measured Values /Current]
I1 Fund.	Measured value (calculated): Positive phase sequence current (Fundamental)	[Operation /Measured Values /Current]
I2 Fund.	Measured value (calculated): Unbalanced load current (Fundamental)	[Operation /Measured Values /Current]
IA RMS	Measured value: Phase current (RMS)	[Operation /Measured Values /Current]
IB RMS	Measured value: Phase current (RMS)	[Operation /Measured Values /Current]
IC RMS	Measured value: Phase current (RMS)	[Operation /Measured Values /Current]
IX meas RMS	Measured value (measured): IX (RMS)	[Operation /Measured Values /Current]
IR calc RMS	Measured value (calculated): IR (RMS)	[Operation /Measured Values /Current]
%IA THD	Measured Value (Calculated): IA Total Harmonic Distortion	[Operation /Measured Values /Current]
%IB THD	Measured Value (Calculated): IB Total Harmonic Distortion	[Operation /Measured Values /Current]

%IC THD	Measured Value (Calculated): IC Total Harmonic Distortion	[Operation /Measured Values /Current]
IA THD	Measured Value (Calculated): IA Total Harmonic Current	[Operation /Measured Values /Current]
IB THD	Measured Value (Calculated): IB Total Harmonic Current	[Operation /Measured Values /Current]
IC THD	Measured Value (Calculated): IC Total Harmonic Current	[Operation /Measured Values /Current]
%(I2/I1)	Measured value (calculated): I2/I1 if ABC, I1/I2 if CBA	[Operation /Measured Values /Current]

Voltage - Measured Values

The first measuring input on the first measuring card (slot with the lowest number) is used as the reference angle.
E.g. »*VA*« respectively »*VAB*«.

f	Measured Value: Frequency	[Operation /Measured Values /Voltage]
V0 Fund.	Measured value (calculated): Symmetrical components Zero voltage(Fundamental)	[Operation /Measured Values /Voltage]
V1 Fund.	Measured value (calculated): Symmetrical components positive phase sequence voltage(Fundamental)	[Operation /Measured Values /Voltage]
V2 Fund.	Measured value (calculated): Symmetrical components negative phase sequence voltage(Fundamental)	[Operation /Measured Values /Voltage]
VAB RMS	Measured value: Phase-to-phase voltage (RMS)	[Operation /Measured Values /Voltage]
VBC RMS	Measured value: Phase-to-phase voltage (RMS)	[Operation /Measured Values /Voltage]

VCA RMS	Measured value: Phase-to-phase voltage (RMS)	[Operation /Measured Values /Voltage]
VA RMS	Measured value: Phase-to-neutral voltage (RMS)	[Operation /Measured Values /Voltage]
VB RMS	Measured value: Phase-to-neutral voltage (RMS)	[Operation /Measured Values /Voltage]
VC RMS	Measured value: Phase-to-neutral voltage (RMS)	[Operation /Measured Values /Voltage]
VX meas RMS	Measured value (measured): VE measured (RMS)	[Operation /Measured Values /Voltage]
VR calc RMS	Measured value (calculated): VR (RMS)	[Operation /Measured Values /Voltage]
Angle VAB	Measured Value (Calculated): Angle of Phasor VAB	[Operation /Measured Values /Voltage]
Angle VBC	Measured Value (Calculated): Angle of Phasor phi VBC	[Operation /Measured Values /Voltage]
Angle VCA	Measured Value (Calculated): Angle of Phasor phi VCA	[Operation /Measured Values /Voltage]
Angle VA	Measured Value (Calculated): Angle of Phasor VA	[Operation /Measured Values /Voltage]
Angle VB	Measured Value (Calculated): Angle of Phasor phi VB	[Operation /Measured Values /Voltage]
Angle VC	Measured Value (Calculated): Angle of Phasor phi VC	[Operation /Measured Values /Voltage]
Angle VX meas	Measured Value: Angle of Phasor VX meas	[Operation /Measured Values /Voltage]

Angle VR calc	Measured Value (Calculated): Angle of Phasor VR calc	[Operation /Measured Values /Voltage]
Angle V0	Measured Value (calculated): Angle of Zero Sequence System	[Operation /Measured Values /Voltage]
Angle V1	Measured Value (calculated): Angle of Positive Sequence System	[Operation /Measured Values /Voltage]
Angle V2	Measured value (calculated): Angle of Negative Sequence System	[Operation /Measured Values /Voltage]
%(V2/V1)	Measured value (calculated): %V2/ V1 if ABC, %V1/V2 if CBA	[Operation /Measured Values /Voltage]
% VAB THD	Measured value (calculated): VAB Total Harmonic Distortion / fundamental	[Operation /Measured Values /Voltage]
% VBC THD	Measured value (calculated): VBC Total Harmonic Distortion / fundamental	[Operation /Measured Values /Voltage]
% VCA THD	Measured value (calculated): VCA Total Harmonic Distortion / fundamental	[Operation /Measured Values /Voltage]
% VA THD	Measured value (calculated): VA Total Harmonic Distortion / fundamental	[Operation /Measured Values /Voltage]
% VB THD	Measured value (calculated): VB Total Harmonic Distortion / fundamental	[Operation /Measured Values /Voltage]
% VC THD	Measured value (calculated): VC Total Harmonic Distortion / fundamental	[Operation /Measured Values /Voltage]
VAB THD	Measured value (calculated): VAB Total Harmonic Distortion	[Operation /Measured Values /Voltage]
VBC THD	Measured value (calculated): VBC Total Harmonic Distortion	[Operation /Measured Values /Voltage]

VCA THD	Measured value (calculated): VCA Total Harmonic Distortion	[Operation /Measured Values /Voltage]
VA THD	Measured value (calculated): VA Total Harmonic Distortion	[Operation /Measured Values /Voltage]
VB THD	VB THD	[Operation /Measured Values /Voltage]
VC THD	VC THD	[Operation /Measured Values /Voltage]

Power - Measured Values

Value	*Description*	*Menu Path*
Disp PF	Measured Value (Calculated): 55D - Displacement Power Factor Power factor	[Operation /Measured Values /Power]
Wh Fwd	Positive Active Power is consumed active energy	[Operation /Measured Values /Energy]
Wh Rev	Negative Active Power (Fed Energy)	[Operation /Measured Values /Energy]
VArh Lag	Positive Reactive Power is consumed Reactive Energy	[Operation /Measured Values /Energy]
VArh Lead	Negative Reactive Power (Fed Energy)	[Operation /Measured Values /Energy]
VAh Net	Net VA Hours	[Operation /Measured Values /Energy]
Wh Net	Net Watt Hours	[Operation /Measured Values /Energy]
VArh Net	Net VAr Hours	[Operation /Measured Values /Energy]

Syst VA RMS	Measured VAs (RMS)	[Operation /Measured Values /Power]
Syst W RMS	Measured Watts. Active power (P- = Fed Active Power, P+ = Consumpted Active Power) (RMS)	[Operation /Measured Values /Power]
Syst VAr RMS	Measured VARs. Reactive power (Q- = Fed Active Power, Q+ = Consumpted Reactive Power) (RMS)	[Operation /Measured Values /Power]
Apt PF	Measured Value (Calculated): 55A - Apparent Power Factor	[Operation /Measured Values /Power]

Energy Counter

EnergyCr

Direct Commands of the Energy Counter Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Res all Energy Cr	Reset of all Energy Counters	Inactive, Active	Inactive	[Operation /Reset]

Signals of the Energy Counter Module (States of the Outputs)

Name	*Description*
Cr Overflow VAh Net	Signal: Counter Overflow VAh Net
Cr Overflow Wh Net	Signal: Counter Overflow Wh Net
Cr Overflow Wh Fwd	Signal: Counter Overflow Wh Fwd
Cr Overflow Wh Rev	Signal: Counter Overflow Wh Rev
Cr Overflow VArh Net	Signal: Counter Overflow VArh Net
Cr Overflow VArh Lag	Signal: Counter Overflow VArh Lag
Cr Overflow VArh Lead	Signal: Counter Overflow VArh Lead
VAh Net Reset Cr	Signal: VAh Net Reset Counter
Wh Net Reset Cr	Signal: Wh Net Reset Counter
Wh Fwd Reset Cr	Signal: Wh Fwd Reset Counter
Wh Rev Reset Cr	Signal: Wh Rev Reset Counter
VArh Net Reset Cr	Signal: VArh Net Reset Counter
VArh Lag Reset Cr	Signal: VArh Lag Reset Counter
VArh Lead Reset Cr	Signal: VArh Lead Reset Counter
Res all Energy Cr	Signal: Reset of all Energy Counters
Cr OverflwWarn VAh Net	Signal: Counter VAh Net will overflow soon
Cr OverflwWarn Wh Net	Signal: Counter Wh Net will overflow soon
Cr OverflwWarn Wh Fwd	Signal: Counter Wh Fwd will overflow soon
Cr OverflwWarn Wh Rev	Signal: Counter Wh Rev will overflow soon
Cr OverflwWarn VArh Net	Signal: Counter VArh Net will overflow soon
Cr OverflwWarn VArh Lag	Signal: Counter VArh Lag will overflow soon
Cr OverflwWarn VArh Lead	Signal: Counter VArh Lead will overflow soon

Statistics

Statistics

In the »Operation/Statistics« menu, the minimum, maximum, and mean values of the measured and calculated quantities can be found. The statistics are ordered by »Standard values« and »Special values« (depending on the type of device and the device planning).

In the »Device Parameter/Statistics« menu, the User can either set a fixed synchronization time and a calculation interval or start and stop the statistics via a function (e.g.: digital input).

Read Out Statistics

•Call up the main menu.

•Call up the »Operation/Statistics« sub-menu.

•Call up either the »Standard values« or »Special values«.

Statistics to Be Read Out Via PowerPort-E

•If PowerPort-E is not running, please start the application.

•If device data have not been downloaded recently, click »Receive Data From The Device« in the »Device« menu.

•Double click on the »Operation« icon in the navigation tree.

•Double click on the »Statistics« icon within the »Operation« navigation tree.

•Double click on the »Standard values« or »Special values« icon.

•In the window, the statistical data are shown in tabular form.

The values can be read out cyclically. For this purpose, please select »Auto Refresh« out of the »View« menu.

Statistics (Configuration)

The Statistics module can be configured within the »Device Parameter/Statistics« menu.

The time interval, that is taken into account for the calculation of the statistics, can either be limited by a fixed duration or it can be limited by a start function (freely assignable signal from the »assignment list« menu).

Fixed Duration:

> If the statistics module is set to a fixed duration/time interval, the minimum, maximum, and average values will be calculated and displayed continuously on the basis of this duration/time interval.

Start Function (Flexible Duration):

> If the statistics module is to be initiated by a start function, the statistics will not be updated until the start function becomes true (rising edge). At the same time, a new time interval will be started.

Statistics (Configuration) Via PowerPort-E

•If PowerPort-E is not running, please start the application.

•If device data have not been downloaded recently, click »Receive Data From The Device« in the»Device« menu.

•Double click on the »Device Parameter« icon in the navigation tree.

•Double click on the »Statistics« icon within the »Device Parameter« navagation tree.

•Configure the Statistics module.

Direct Commands

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset	Reset of statistics	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Statistics Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start via:	Start statistics by:	Duration, StartFct	Duration	[Device Para /Statistics]
StartFct	Update the displayed statistics and start new measuring interval if the assigned signal becomes true (rising edge): Only available if: Start via: = StartFct	1..n, Assignment List	-.-	[Device Para /Statistics]
ResetFct	Reset of statistics if the assigned signal becomes true (slope).	1..n, Assignment List	-.-	[Device Para /Statistics]
Duration	Recording time Only available if: Start via: = Duration	15 s, 30 s, 1 min, 10 min, 30 min, 1 h, 2 h, 6 h, 12 h, 1 d, 2 d, 5 d, 7 d, 10 d, 30 d	15 s	[Device Para /Statistics]

States of the Inputs of the Statistics Module

Name	*Description*	*Assignment Via*
StartFct-I	Module input state: Start statistics Module input signal	[Device Para /Statistics]
ResetFct-I	Module Input State: Reset Statistics Module input signal	[Device Para /Statistics]

Signals of the Statistics Module

Name	*Description*
Reset	Signal: Reset of Statistics

Counters of the Module Statistics

Value	*Description*	*Menu Path*
MeasPointNo	Each measuring point that is taken over by the statistics increments this counter. By means of this counter, the User can check whether the statistics are alive and if data are being acquired.	[Operation /Count and RevData /Statistics]

Current - Statistic Values

I1 max Fund.	Maximum value positive phase sequence current (Fundamental)	[Operation /Statistics /Current]
I1 avg Fund.	Average value positive phase sequence current (Fundamental)	[Operation /Statistics /Current]
I1 min Fund.	Minimum value positive phase sequence current (Fundamental)	[Operation /Statistics /Current]
I2 max Fund.	Maximum value unbalanced load current (Fundamental)	[Operation /Statistics /Current]
I2 avg Fund.	Average value unbalanced load current (Fundamental)	[Operation /Statistics /Current]
I2 min Fund.	Minimum value unbalanced load current (Fundamental)	[Operation /Statistics /Current]
IA max RMS	IA maximum value (RMS)	[Operation /Statistics /Current]
IA avg RMS	IA average value (RMS)	[Operation /Statistics /Current]
IA min RMS	IA minimum value (RMS)	[Operation /Statistics /Current]
IB max RMS	IB maximum value (RMS)	[Operation /Statistics /Current]
IB avg RMS	IB average value (RMS)	[Operation /Statistics /Current]
IB min RMS	IB minimum value (RMS)	[Operation /Statistics /Current]
IC max RMS	IC maximum value (RMS)	[Operation /Statistics /Current]

IC avg RMS	IC average value (RMS)	[Operation /Statistics /Current]
IC min RMS	IC minimum value (RMS)	[Operation /Statistics /Current]
IX meas max RMS	Measured value: IX maximum value (RMS)	[Operation /Statistics /Current]
IX meas avg RMS	Measured value: IX average value (RMS)	[Operation /Statistics /Current]
IX meas min RMS	Measured value: IX minimum value (RMS)	[Operation /Statistics /Current]
IR calc max RMS	Measured value (calculated): IR maximum value (RMS)	[Operation /Statistics /Current]
IR calc avg RMS	Measured value (calculated): IR average value (RMS)	[Operation /Statistics /Current]
IR calc min RMS	Measured value (calculated): IR minimum value (RMS)	[Operation /Statistics /Current]
%IA THD max	IATotal Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Current]
%IB THD max	IBTotal Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Current]
%IC THD max	ICTotal Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Current]
IA THD max	IA Total Harmonic Current maximum value	[Operation /Statistics /Current]
IB THD max	IB Total Harmonic Current maximum value	[Operation /Statistics /Current]

IC THD max	IC Total Harmonic Current maximum value	[Operation /Statistics /Current]
%(I2/I1) max	Measured value (calculated): I2/I1 maximum value if ABC, I1/I2 if CBA	[Operation /Statistics /Current]
%(I2/I1) avg	Measured value (calculated): I2/I1 maximum value if ABC, I1/I2 if CBA	[Operation /Statistics /Current]
%(I2/I1) min	%(I2/I1) min	[Operation /Statistics /Current]

Voltage - Statistic Values

f max	Max. frequency value	[Operation /Statistics /Voltage]
f avg	Average frequency value	[Operation /Statistics /Voltage]
f min	Min. frequency value	[Operation /Statistics /Voltage]
V1 max Fund.	Maximum value: Symmetrical components positive phase sequence voltage(Fundamental)	[Operation /Statistics /Voltage]
V1 avg Fund.	Average value: Symmetrical components positive phase sequence voltage(Fundamental)	[Operation /Statistics /Voltage]
V1 min Fund.	Minimum value: Symmetrical components positive phase sequence voltage(Fundamental)	[Operation /Statistics /Voltage]
V2 max Fund.	Maximum value: Symmetrical components negative phase sequence voltage(Fundamental)	[Operation /Statistics /Voltage]
V2 avg Fund.	Average value: Symmetrical components negative phase sequence voltage(Fundamental)	[Operation /Statistics /Voltage]
V2 min Fund.	Minimum value: Symmetrical components negative phase sequence voltage(Fundamental)	[Operation /Statistics /Voltage]
VAB max RMS	VAB maximum value (RMS)	[Operation /Statistics /Voltage]
VAB avg RMS	VAB average value (RMS)	[Operation /Statistics /Voltage]
VAB min RMS	VAB average value (RMS)	[Operation /Statistics /Voltage]
VBC max RMS	VBC maximum value (RMS)	[Operation /Statistics /Voltage]

VBC avg RMS	VBC average value (RMS)	[Operation /Statistics /Voltage]
VBC min RMS	VBC average value (RMS)	[Operation /Statistics /Voltage]
VCA max RMS	VCA maximum value (RMS)	[Operation /Statistics /Voltage]
VCA avg RMS	VCA average value (RMS)	[Operation /Statistics /Voltage]
VCA min RMS	VCA average value (RMS)	[Operation /Statistics /Voltage]
VA max RMS	VA maximum value (RMS)	[Operation /Statistics /Voltage]
VA avg RMS	VA average value (RMS)	[Operation /Statistics /Voltage]
VA min RMS	VA minimum value (RMS)	[Operation /Statistics /Voltage]
VB max RMS	VB maximum value (RMS)	[Operation /Statistics /Voltage]
VB avg RMS	VB average value (RMS)	[Operation /Statistics /Voltage]
VB min RMS	VB minimum value (RMS)	[Operation /Statistics /Voltage]
VC max RMS	VC maximum value (RMS)	[Operation /Statistics /Voltage]
VC avg RMS	VC average value (RMS)	[Operation /Statistics /Voltage]

VC min RMS	VC minimum value (RMS)	[Operation /Statistics /Voltage]
VX meas max RMS	Measured value: VX maximum value (RMS)	[Operation /Statistics /Voltage]
VX meas avg RMS	Measured value: VX average value (RMS)	[Operation /Statistics /Voltage]
VX meas min RMS	Measured value: VX minimum value (RMS)	[Operation /Statistics /Voltage]
VR calc max RMS	Measured value (calculated): VR maximum value (RMS)	[Operation /Statistics /Voltage]
VR calc avg RMS	Measured value (calculated): VR average value (RMS)	[Operation /Statistics /Voltage]
VR calc min RMS	Measured value (calculated): VR minimum value (RMS)	[Operation /Statistics /Voltage]
%(V2/V1) max	Measured value (calculated): %V2/ V1 maximum value	[Operation /Statistics /Voltage]
%(V2/V1) avg	Measured value (calculated): %V2/ V1 average value	[Operation /Statistics /Voltage]
%(V2/V1) min	Measured value (calculated): %V2/ V1 minimum value	[Operation /Statistics /Voltage]
% VAB THD max	Measured value (calculated): VAB Total Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Voltage]
% VBC THD max	Measured value (calculated): VBC Total Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Voltage]
% VCA THD max	Measured value (calculated): VCA Total Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Voltage]

% VA THD max	Measured value (calculated): VA Total Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Voltage]
% VB THD max	Measured value (calculated): VB Total Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Voltage]
% VC THD max	Measured value (calculated): VC Total Harmonic Distortion maximum value / fundamental	[Operation /Statistics /Voltage]
VAB THD max	Measured value (calculated): VAB Total Harmonic Distortion maximum value	[Operation /Statistics /Voltage]
VBC THD max	Measured value (calculated): VBC Total Harmonic Distortion maximum value	[Operation /Statistics /Voltage]
VCA THD max	Measured value (calculated): VCA Total Harmonic Distortion maximum value	[Operation /Statistics /Voltage]
VA THD max	Measured value (calculated): VA Total Harmonic Distortion maximum value	[Operation /Statistics /Voltage]
VB THD max	Measured value (calculated): VB Total Harmonic Distortion maximum value	[Operation /Statistics /Voltage]
VC THD max	Measured value (calculated): VC Total Harmonic Distortion maximum value	[Operation /Statistics /Voltage]

Power - Statistic Values

Value	*Description*	*Menu Path*
Disp PF max	Maximum value of the 55D - Displacement Power Factor power factor	[Operation /Statistics /Power]
Disp PF avg	Average of the 55D - Displacement Power Factor power factor	[Operation /Statistics /Power]
Disp PF min	Minimum value of the 55D - Displacement Power Factor power factor	[Operation /Statistics /Power]
Syst VA max	Maximum value of the apparent power	[Operation /Statistics /Power]
Syst VA avg	Average of the apparent power	[Operation /Statistics /Power]
Syst VA min	Minimum value of the apparent power	[Operation /Statistics /Power]
Syst W max	Maximum value of the active power	[Operation /Statistics /Power]
Syst W avg	Average of the active power	[Operation /Statistics /Power]
Syst W min	Minimum value of the active power	[Operation /Statistics /Power]
Syst VAr max	Maximum value of the reactive power	[Operation /Statistics /Power]
Syst VAr avg	Average of the reactive power	[Operation /Statistics /Power]
Syst VAr min	Minimum value of the reactive power	[Operation /Statistics /Power]

Apt PF max	Maximum value of the 55A - Apparent Power Factor	[Operation /Statistics /Power]
Apt PF avg	Average of the 55A - Apparent Power Factor	[Operation /Statistics /Power]
Apt PF min	Minimum value of the 55A - Apparent Power Factor	[Operation /Statistics /Power]

Resets

Collective Acknowledgments for Latched Signals:

Collective Acknowledgments					
	LEDs	*Relay Outputs*	*SCADA*	*Pending Trip Command*	*LEDs+ Relay Outputs+ SCADA+ Pending Trip Command*
Via **PowerPort-E** or at the ***panel all...*** can be acknowledged. At the panel, the [Operation\ Acknowledge] menu can directly be accessed via the **»C«** key.	All LEDs at once: Where? [Operation\ Acknowledge]	All Relay Outputs at once: Where? [Operation\ Acknowledge]	All SCADA signals at once: Where? [Operation\ Acknowledge]	All pending trip commands at once: Where? [Operation\ Acknowledge]	All at once: Where? [Operation\ Acknowledge]
External Acknowledg-ment: Via a signal from the assignment list (e.g.: a digital Input) ***all***... can be acknowledged.	All LEDs at once: Where? Within the *Ex Acknowledge menu.*	All Relay Outputs at once: Where? Within the *Ex Acknowledge menu.*	All SCADA signals at once: Where? Within the *Ex Acknowledge menu.*	All Pending Trip commands at once: Where? Within the *Ex Acknowledge menu.*	All at once: Where? Within the *Ex Acknowledge menu.*

Options for Individual Acknowledgments for Latched Signals:

Individual Acknowledgment			
	LEDs	*Relay Output*	*Pending Trip Command*
Via a signal from the assignment list (e.g.: a digital Input), a ***single***... can be acknowledged.	Single LED: Where? Within the Configuration menu of this single LED.	Relay Output: Where? Within the Configuration menu of this single Relay Output.	Pending Trip Command. Where? Within the module *TripControl*

NOTICE

If the User is within the parameter setting mode, the User cannot acknowledge.

NOTICE

In case of a fault during parameter setting via the operating panel, the User must first leave the parameter mode by pressing either the push-buttons »C« or »OK« before accessing the »Acknowledgements« menu via the push-button.

Manual Acknowledgment

•Press the »C« button on the panel.
•Select the item to be acknowledged via the softkeys:

- •Relay Outputs;
- •LEDs;
- •SCADA;
- •A trip command; or
- •All the above mentioned items at once.

•Press the Softkey with the »Wrench-Symbol«.
•Enter the password.

Manual Acknowledgment Via PowerPort-E

•If PowerPort-E is not running, please start the application.

•If device data have not been downloaded recently, select »Receive Data From The Device« from the »Device« menu.

•Double click on the »Operation« icon in the navigation tree.

•Double click on the »Acknowledgment« icon within the operation menu.

•Double click the entry within the pop-up that is to be acknowledged.

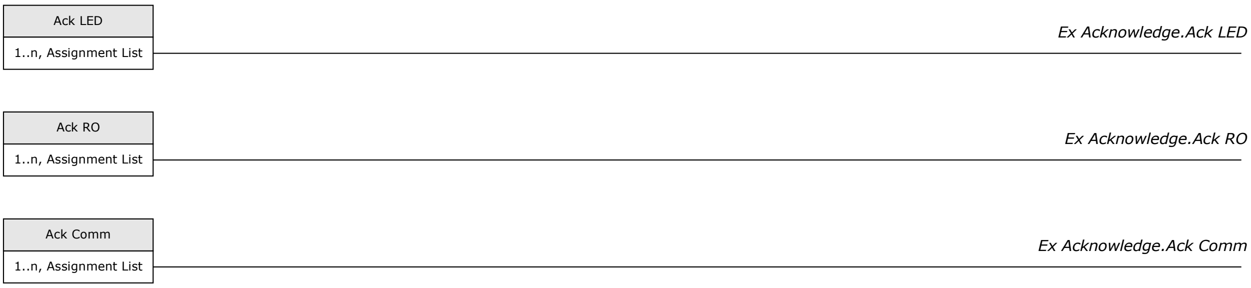
•Press the »Execute immediately« button.

•Enter the password.

External Acknowledgments

Within the [Ex Acknowledge] menu, the User can assign a signal (e.g.: the state of a digital input) from the assignment list that:

•Acknowledges all (acknowledgeable) LEDs at once;
•Acknowledges all (acknowledgeable) Output Relays at once; or
•Acknowledges all (acknowledgeable) SCADA signals at once.



Within the [Protection Para\Global Prot Para\TripControl] menu, the User can assign a signal that acknowledges a pending trip command.

For details, please refer to the Trip Control *section*.

External Acknowledge Via PowerPort-E

•If PowerPort-E is not running, please start the application.

•If device data have not been downloaded recently, select »Receive Data From The Device« from the »Device« menu.

•Double click on the »Device Parameter« icon in the navigation tree.

•Double click on the »Ex Acknowledge« icon within the operation menu.

•In the working window, the User can now assign each signal that resets all acknowledgeable LEDs, a signal that resets all Relay Outputs, a signal that resets the SCADA signals respectively, and a signal that acknowledges a pending trip command.

External LED - Acknowledgment Signals

The following signals can be used for external acknowledgment of latched LEDs.

Name	*Description*
-.-	No assignment
DI-8P X1.DI 1	Signal: Digital Input
DI-8P X1.DI 2	Signal: Digital Input
DI-8P X1.DI 3	Signal: Digital Input
DI-8P X1.DI 4	Signal: Digital Input
DI-8P X1.DI 5	Signal: Digital Input
DI-8P X1.DI 6	Signal: Digital Input
DI-8P X1.DI 7	Signal: Digital Input
DI-8P X1.DI 8	Signal: Digital Input
Modbus.Comm Cmd 1	Communication Command
Modbus.Comm Cmd 2	Communication Command
Modbus.Comm Cmd 3	Communication Command
Modbus.Comm Cmd 4	Communication Command
Modbus.Comm Cmd 5	Communication Command
Modbus.Comm Cmd 6	Communication Command
Modbus.Comm Cmd 7	Communication Command
Modbus.Comm Cmd 8	Communication Command
Modbus.Comm Cmd 9	Communication Command
Modbus.Comm Cmd 10	Communication Command
Modbus.Comm Cmd 11	Communication Command
Modbus.Comm Cmd 12	Communication Command
Modbus.Comm Cmd 13	Communication Command
Modbus.Comm Cmd 14	Communication Command
Modbus.Comm Cmd 15	Communication Command
Modbus.Comm Cmd 16	Communication Command

Manual Resets

In the *»Operation/Reset«* menu, the User can:

•Reset counters;
•Delete records (e.g.: disturbance records); and
•Reset special things (like statistics, thermal replica, etc.).

NOTICE **The description of the reset commands can be found within the corresponding modules.**

Manual Resets Via PowerPort-E

•If PowerPort-E is not running, please start the application.

•If device data have not been downloaded recently, click »Receive Data From The Device« in the »Device« menu.

•Double click the »Operation« icon in the navigation tree.

•Double click the »Reset icon« within the operation menu.

•Double click the entry within the pop-up that is to be reset or deleted.

NOTICE **The description of the reset commands can be found within the corresponding modules.**

Assignment List

The »ASSIGNMENT LIST« below summarizes all module outputs (signals) and inputs (e.g.: states of the assignments).

Name	*Description*
-.-	No assignment
Prot.Available	Signal: Protection is available.
Prot.Active	Signal: Active
Prot.ExBlo	Signal: External Blocking
Prot.Pickup Phase A	Signal: General Pickup Phase A
Prot.Pickup Phase B	Signal: General Pickup Phase B
Prot.Pickup Phase C	Signal: General Pickup Phase C
Prot.Pickup IX or IR	Signal: General Pickup - Ground Fault
Prot.Pickup	Signal: General Pickup
Prot.Trip Phase A	Signal: General Trip Phase A
Prot.Trip Phase B	Signal: General Trip Phase B
Prot.Trip Phase C	Signal: General Trip Phase C
Prot.Trip IX or IR	Signal: General Trip Ground Fault
Prot.Trip	Signal: General Trip
Prot.Res Fault a Mains No	Signal: Resetting of fault number and number of grid faults.
Prot.ExBlo1-I	Module Input State: External Blocking1
Prot.ExBlo2-I	Module Input State: External Blocking2
EnergyCr.Cr Overflow VAh Net	Signal: Counter Overflow VAh Net
EnergyCr.Cr Overflow Wh Net	Signal: Counter Overflow Wh Net
EnergyCr.Cr Overflow Wh Fwd	Signal: Counter Overflow Wh Fwd
EnergyCr.Cr Overflow Wh Rev	Signal: Counter Overflow Wh Rev
EnergyCr.Cr Overflow VArh Net	Signal: Counter Overflow VArh Net
EnergyCr.Cr Overflow VArh Lag	Signal: Counter Overflow VArh Lag
EnergyCr.Cr Overflow VArh Lead	Signal: Counter Overflow VArh Lead
EnergyCr.VAh Net Reset Cr	Signal: VAh Net Reset Counter
EnergyCr.Wh Net Reset Cr	Signal: Wh Net Reset Counter
EnergyCr.Wh Fwd Reset Cr	Signal: Wh Fwd Reset Counter
EnergyCr.Wh Rev Reset Cr	Signal: Wh Rev Reset Counter
EnergyCr.VArh Net Reset Cr	Signal: VArh Net Reset Counter
EnergyCr.VArh Lag Reset Cr	Signal: VArh Lag Reset Counter
EnergyCr.VArh Lead Reset Cr	Signal: VArh Lead Reset Counter
EnergyCr.Res all Energy Cr	Signal: Reset of all Energy Counters
EnergyCr.Cr OverflwWarn VAh Net	Signal: Counter VAh Net will overflow soon
EnergyCr.Cr OverflwWarn Wh Net	Signal: Counter Wh Net will overflow soon
EnergyCr.Cr OverflwWarn Wh Fwd	Signal: Counter Wh Fwd will overflow soon

Name	*Description*
EnergyCr.Cr OverflwWarn Wh Rev	Signal: Counter Wh Rev will overflow soon
EnergyCr.Cr OverflwWarn VArh Net	Signal: Counter VArh Net will overflow soon
EnergyCr.Cr OverflwWarn VArh Lag	Signal: Counter VArh Lag will overflow soon
EnergyCr.Cr OverflwWarn VArh Lead	Signal: Counter VArh Lead will overflow soon
Bkr.TripCmd	Signal: Trip Command
Bkr.Ack TripCmd	Signal: Acknowledge Trip Command
Bkr.Ready	Signal: Breaker is ready for operation.
Bkr.Manual OPEN	Signal: Breaker was switched off manually.
Bkr.Ex Manual CLOSE CMD	Signal: External manual breaker CLOSE command (NOT for AR!)
Bkr.Pos OPEN	Signal: Breaker is in OPEN-Position
Bkr.Pos CLOSE	Signal: Breaker is in CLOSE-Position
Bkr.Pos Indeterm	Signal: Breaker is in Indeterminate Position
Bkr.Pos Disturb	Signal: Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.
Bkr.Acknow Sig-I	Module Input State: Acknowledgment Signal (only for automatic acknowledgment). Module input signal
Bkr.CinBkr-52a-I	Position indicator/check-back signal of the Bkr (52a)
Bkr.CinBkr-52b-I	Module Input State: Position indicator/check-back signal of the Bkr. (52b)
Bkr.Ex Manual CLOSE CMD-I	Module Input State: External manual breaker CLOSE command (NOT for AR!)
Bkr.Manual OPEN-I	Module Input State: Breaker was switched off (OPEN) manually.
Bkr.Ready-I	Module Input State: Breaker Ready
BWear.Active	Signal: Active
BWear.ExBlo	Signal: External Blocking
BWear.Operations Alarm	Signal: Service Alarm, too many Operations
BWear.Isum Intr trip: IA	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IA
BWear.Isum Intr trip: IB	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IB
BWear.Isum Intr trip: IC	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded: IC
BWear.Isum Intr trip	Signal: Maximum permissible Summation of the interruppting (tripping) currents exceeded in at least one phase.
BWear.Res TripCmdCr	Signal: Resetting of the Counter: total number of trip commands
BWear.Res Isum trip	Signal: Reset summation of the tripping currents
BWear.ExBlo1-I	Module Input State: External Blocking1
BWear.ExBlo2-I	Module Input State: External Blocking2
50P[1].Active	Signal: Active

Name	*Description*
50P[1].ExBlo	Signal: External Blocking
50P[1].Rvs Blo	Signal: Reverse Blocking
50P[1].Blo TripCmd	Signal: Trip Command blocked
50P[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50P[1].Pickup IA	Signal: Pickup IA
50P[1].Pickup IB	Signal: Pickup IB
50P[1].Pickup IC	Signal: Pickup IC
50P[1].Pickup	Signal: Pickup
50P[1].Trip Phase A	Signal: General Trip Phase A
50P[1].Trip Phase B	Signal: General Trip Phase B
50P[1].Trip Phase C	Signal: General Trip Phase C
50P[1].Trip	Signal: Trip
50P[1].TripCmd	Signal: Trip Command
50P[1].DefaultSet	Signal: Default Parameter Set
50P[1].AdaptSet 1	Signal: Adaptive Parameter 1
50P[1].AdaptSet 2	Signal: Adaptive Parameter 2
50P[1].AdaptSet 3	Signal: Adaptive Parameter 3
50P[1].AdaptSet 4	Signal: Adaptive Parameter 4
50P[1].ExBlo1-I	Module Input State: External Blocking1
50P[1].ExBlo2-I	Module Input State: External Blocking2
50P[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[1].Rvs Blo-I	Module Input State: Reverse Blocking
50P[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
50P[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
50P[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
50P[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
50P[2].Active	Signal: Active
50P[2].ExBlo	Signal: External Blocking
50P[2].Rvs Blo	Signal: Reverse Blocking
50P[2].Blo TripCmd	Signal: Trip Command blocked
50P[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50P[2].Pickup IA	Signal: Pickup IA
50P[2].Pickup IB	Signal: Pickup IB
50P[2].Pickup IC	Signal: Pickup IC
50P[2].Pickup	Signal: Pickup
50P[2].Trip Phase A	Signal: General Trip Phase A
50P[2].Trip Phase B	Signal: General Trip Phase B
50P[2].Trip Phase C	Signal: General Trip Phase C
50P[2].Trip	Signal: Trip
50P[2].TripCmd	Signal: Trip Command

Name	*Description*
50P[2].DefaultSet	Signal: Default Parameter Set
50P[2].AdaptSet 1	Signal: Adaptive Parameter 1
50P[2].AdaptSet 2	Signal: Adaptive Parameter 2
50P[2].AdaptSet 3	Signal: Adaptive Parameter 3
50P[2].AdaptSet 4	Signal: Adaptive Parameter 4
50P[2].ExBlo1-I	Module Input State: External Blocking1
50P[2].ExBlo2-I	Module Input State: External Blocking2
50P[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[2].Rvs Blo-I	Module Input State: Reverse Blocking
50P[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
50P[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
50P[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
50P[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
50P[3].Active	Signal: Active
50P[3].ExBlo	Signal: External Blocking
50P[3].Rvs Blo	Signal: Reverse Blocking
50P[3].Blo TripCmd	Signal: Trip Command blocked
50P[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50P[3].Pickup IA	Signal: Pickup IA
50P[3].Pickup IB	Signal: Pickup IB
50P[3].Pickup IC	Signal: Pickup IC
50P[3].Pickup	Signal: Pickup
50P[3].Trip Phase A	Signal: General Trip Phase A
50P[3].Trip Phase B	Signal: General Trip Phase B
50P[3].Trip Phase C	Signal: General Trip Phase C
50P[3].Trip	Signal: Trip
50P[3].TripCmd	Signal: Trip Command
50P[3].DefaultSet	Signal: Default Parameter Set
50P[3].AdaptSet 1	Signal: Adaptive Parameter 1
50P[3].AdaptSet 2	Signal: Adaptive Parameter 2
50P[3].AdaptSet 3	Signal: Adaptive Parameter 3
50P[3].AdaptSet 4	Signal: Adaptive Parameter 4
50P[3].ExBlo1-I	Module Input State: External Blocking1
50P[3].ExBlo2-I	Module Input State: External Blocking2
50P[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50P[3].Rvs Blo-I	Module Input State: Reverse Blocking
50P[3].AdaptSet1-I	Module Input State: Adaptive Parameter1
50P[3].AdaptSet2-I	Module Input State: Adaptive Parameter2
50P[3].AdaptSet3-I	Module Input State: Adaptive Parameter3

Name	Description
50P[3].AdaptSet4-I	Module Input State: Adaptive Parameter4
51P[1].Active	Signal: Active
51P[1].ExBlo	Signal: External Blocking
51P[1].Rvs Blo	Signal: Reverse Blocking
51P[1].Blo TripCmd	Signal: Trip Command blocked
51P[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51P[1].Pickup IA	Signal: Pickup IA
51P[1].Pickup IB	Signal: Pickup IB
51P[1].Pickup IC	Signal: Pickup IC
51P[1].Pickup	Signal: Pickup
51P[1].Trip Phase A	Signal: General Trip Phase A
51P[1].Trip Phase B	Signal: General Trip Phase B
51P[1].Trip Phase C	Signal: General Trip Phase C
51P[1].Trip	Signal: Trip
51P[1].TripCmd	Signal: Trip Command
51P[1].DefaultSet	Signal: Default Parameter Set
51P[1].AdaptSet 1	Signal: Adaptive Parameter 1
51P[1].AdaptSet 2	Signal: Adaptive Parameter 2
51P[1].AdaptSet 3	Signal: Adaptive Parameter 3
51P[1].AdaptSet 4	Signal: Adaptive Parameter 4
51P[1].ExBlo1-I	Module Input State: External Blocking1
51P[1].ExBlo2-I	Module Input State: External Blocking2
51P[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51P[1].Rvs Blo-I	Module Input State: Reverse Blocking
51P[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
51P[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
51P[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
51P[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
51P[2].Active	Signal: Active
51P[2].ExBlo	Signal: External Blocking
51P[2].Rvs Blo	Signal: Reverse Blocking
51P[2].Blo TripCmd	Signal: Trip Command blocked
51P[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51P[2].Pickup IA	Signal: Pickup IA
51P[2].Pickup IB	Signal: Pickup IB
51P[2].Pickup IC	Signal: Pickup IC
51P[2].Pickup	Signal: Pickup
51P[2].Trip Phase A	Signal: General Trip Phase A
51P[2].Trip Phase B	Signal: General Trip Phase B
51P[2].Trip Phase C	Signal: General Trip Phase C

Name	*Description*
51P[2].Trip	Signal: Trip
51P[2].TripCmd	Signal: Trip Command
51P[2].DefaultSet	Signal: Default Parameter Set
51P[2].AdaptSet 1	Signal: Adaptive Parameter 1
51P[2].AdaptSet 2	Signal: Adaptive Parameter 2
51P[2].AdaptSet 3	Signal: Adaptive Parameter 3
51P[2].AdaptSet 4	Signal: Adaptive Parameter 4
51P[2].ExBlo1-I	Module Input State: External Blocking1
51P[2].ExBlo2-I	Module Input State: External Blocking2
51P[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51P[2].Rvs Blo-I	Module Input State: Reverse Blocking
51P[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
51P[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
51P[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
51P[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
51P[3].Active	Signal: Active
51P[3].ExBlo	Signal: External Blocking
51P[3].Rvs Blo	Signal: Reverse Blocking
51P[3].Blo TripCmd	Signal: Trip Command blocked
51P[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51P[3].Pickup IA	Signal: Pickup IA
51P[3].Pickup IB	Signal: Pickup IB
51P[3].Pickup IC	Signal: Pickup IC
51P[3].Pickup	Signal: Pickup
51P[3].Trip Phase A	Signal: General Trip Phase A
51P[3].Trip Phase B	Signal: General Trip Phase B
51P[3].Trip Phase C	Signal: General Trip Phase C
51P[3].Trip	Signal: Trip
51P[3].TripCmd	Signal: Trip Command
51P[3].DefaultSet	Signal: Default Parameter Set
51P[3].AdaptSet 1	Signal: Adaptive Parameter 1
51P[3].AdaptSet 2	Signal: Adaptive Parameter 2
51P[3].AdaptSet 3	Signal: Adaptive Parameter 3
51P[3].AdaptSet 4	Signal: Adaptive Parameter 4
51P[3].ExBlo1-I	Module Input State: External Blocking1
51P[3].ExBlo2-I	Module Input State: External Blocking2
51P[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51P[3].Rvs Blo-I	Module Input State: Reverse Blocking
51P[3].AdaptSet1-I	Module Input State: Adaptive Parameter1

Name	*Description*
51P[3].AdaptSet2-I	Module Input State: Adaptive Parameter2
51P[3].AdaptSet3-I	Module Input State: Adaptive Parameter3
51P[3].AdaptSet4-I	Module Input State: Adaptive Parameter4
50X[1].Active	Signal: Active
50X[1].ExBlo	Signal: External Blocking
50X[1].Rvs Blo	Signal: Reverse Blocking
50X[1].Blo TripCmd	Signal: Trip Command blocked
50X[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50X[1].Pickup	Signal: Pickup IX or IR
50X[1].Trip	Signal: Trip
50X[1].TripCmd	Signal: Trip Command
50X[1].DefaultSet	Signal: Default Parameter Set
50X[1].AdaptSet 1	Signal: Adaptive Parameter 1
50X[1].AdaptSet 2	Signal: Adaptive Parameter 2
50X[1].AdaptSet 3	Signal: Adaptive Parameter 3
50X[1].AdaptSet 4	Signal: Adaptive Parameter 4
50X[1].ExBlo1-I	Module Input State: External Blocking1
50X[1].ExBlo2-I	Module Input State: External Blocking2
50X[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50X[1].Rvs Blo-I	Module Input State: Reverse Blocking
50X[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
50X[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
50X[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
50X[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
50X[2].Active	Signal: Active
50X[2].ExBlo	Signal: External Blocking
50X[2].Rvs Blo	Signal: Reverse Blocking
50X[2].Blo TripCmd	Signal: Trip Command blocked
50X[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50X[2].Pickup	Signal: Pickup IX or IR
50X[2].Trip	Signal: Trip
50X[2].TripCmd	Signal: Trip Command
50X[2].DefaultSet	Signal: Default Parameter Set
50X[2].AdaptSet 1	Signal: Adaptive Parameter 1
50X[2].AdaptSet 2	Signal: Adaptive Parameter 2
50X[2].AdaptSet 3	Signal: Adaptive Parameter 3
50X[2].AdaptSet 4	Signal: Adaptive Parameter 4
50X[2].ExBlo1-I	Module Input State: External Blocking1
50X[2].ExBlo2-I	Module Input State: External Blocking2

Name	*Description*
50X[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50X[2].Rvs Blo-I	Module Input State: Reverse Blocking
50X[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
50X[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
50X[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
50X[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
51X[1].Active	Signal: Active
51X[1].ExBlo	Signal: External Blocking
51X[1].Rvs Blo	Signal: Reverse Blocking
51X[1].Blo TripCmd	Signal: Trip Command blocked
51X[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51X[1].Pickup	Signal: Pickup IX or IR
51X[1].Trip	Signal: Trip
51X[1].TripCmd	Signal: Trip Command
51X[1].DefaultSet	Signal: Default Parameter Set
51X[1].AdaptSet 1	Signal: Adaptive Parameter 1
51X[1].AdaptSet 2	Signal: Adaptive Parameter 2
51X[1].AdaptSet 3	Signal: Adaptive Parameter 3
51X[1].AdaptSet 4	Signal: Adaptive Parameter 4
51X[1].ExBlo1-I	Module Input State: External Blocking1
51X[1].ExBlo2-I	Module Input State: External Blocking2
51X[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51X[1].Rvs Blo-I	Module Input State: Reverse Blocking
51X[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
51X[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
51X[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
51X[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
51X[2].Active	Signal: Active
51X[2].ExBlo	Signal: External Blocking
51X[2].Rvs Blo	Signal: Reverse Blocking
51X[2].Blo TripCmd	Signal: Trip Command blocked
51X[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51X[2].Pickup	Signal: Pickup IX or IR
51X[2].Trip	Signal: Trip
51X[2].TripCmd	Signal: Trip Command
51X[2].DefaultSet	Signal: Default Parameter Set
51X[2].AdaptSet 1	Signal: Adaptive Parameter 1
51X[2].AdaptSet 2	Signal: Adaptive Parameter 2
51X[2].AdaptSet 3	Signal: Adaptive Parameter 3

Name	Description
51X[2].AdaptSet 4	Signal: Adaptive Parameter 4
51X[2].ExBlo1-I	Module Input State: External Blocking1
51X[2].ExBlo2-I	Module Input State: External Blocking2
51X[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51X[2].Rvs Blo-I	Module Input State: Reverse Blocking
51X[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
51X[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
51X[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
51X[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
50R[1].Active	Signal: Active
50R[1].ExBlo	Signal: External Blocking
50R[1].Rvs Blo	Signal: Reverse Blocking
50R[1].Blo TripCmd	Signal: Trip Command blocked
50R[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50R[1].Pickup	Signal: Pickup IX or IR
50R[1].Trip	Signal: Trip
50R[1].TripCmd	Signal: Trip Command
50R[1].DefaultSet	Signal: Default Parameter Set
50R[1].AdaptSet 1	Signal: Adaptive Parameter 1
50R[1].AdaptSet 2	Signal: Adaptive Parameter 2
50R[1].AdaptSet 3	Signal: Adaptive Parameter 3
50R[1].AdaptSet 4	Signal: Adaptive Parameter 4
50R[1].ExBlo1-I	Module Input State: External Blocking1
50R[1].ExBlo2-I	Module Input State: External Blocking2
50R[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50R[1].Rvs Blo-I	Module Input State: Reverse Blocking
50R[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
50R[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
50R[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
50R[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
50R[2].Active	Signal: Active
50R[2].ExBlo	Signal: External Blocking
50R[2].Rvs Blo	Signal: Reverse Blocking
50R[2].Blo TripCmd	Signal: Trip Command blocked
50R[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
50R[2].Pickup	Signal: Pickup IX or IR
50R[2].Trip	Signal: Trip
50R[2].TripCmd	Signal: Trip Command
50R[2].DefaultSet	Signal: Default Parameter Set

Name	Description
50R[2].AdaptSet 1	Signal: Adaptive Parameter 1
50R[2].AdaptSet 2	Signal: Adaptive Parameter 2
50R[2].AdaptSet 3	Signal: Adaptive Parameter 3
50R[2].AdaptSet 4	Signal: Adaptive Parameter 4
50R[2].ExBlo1-I	Module Input State: External Blocking1
50R[2].ExBlo2-I	Module Input State: External Blocking2
50R[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
50R[2].Rvs Blo-I	Module Input State: Reverse Blocking
50R[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
50R[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
50R[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
50R[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
51R[1].Active	Signal: Active
51R[1].ExBlo	Signal: External Blocking
51R[1].Rvs Blo	Signal: Reverse Blocking
51R[1].Blo TripCmd	Signal: Trip Command blocked
51R[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51R[1].Pickup	Signal: Pickup IX or IR
51R[1].Trip	Signal: Trip
51R[1].TripCmd	Signal: Trip Command
51R[1].DefaultSet	Signal: Default Parameter Set
51R[1].AdaptSet 1	Signal: Adaptive Parameter 1
51R[1].AdaptSet 2	Signal: Adaptive Parameter 2
51R[1].AdaptSet 3	Signal: Adaptive Parameter 3
51R[1].AdaptSet 4	Signal: Adaptive Parameter 4
51R[1].ExBlo1-I	Module Input State: External Blocking1
51R[1].ExBlo2-I	Module Input State: External Blocking2
51R[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51R[1].Rvs Blo-I	Module Input State: Reverse Blocking
51R[1].AdaptSet1-I	Module Input State: Adaptive Parameter1
51R[1].AdaptSet2-I	Module Input State: Adaptive Parameter2
51R[1].AdaptSet3-I	Module Input State: Adaptive Parameter3
51R[1].AdaptSet4-I	Module Input State: Adaptive Parameter4
51R[2].Active	Signal: Active
51R[2].ExBlo	Signal: External Blocking
51R[2].Rvs Blo	Signal: Reverse Blocking
51R[2].Blo TripCmd	Signal: Trip Command blocked
51R[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
51R[2].Pickup	Signal: Pickup IX or IR

Name	*Description*
51R[2].Trip	Signal: Trip
51R[2].TripCmd	Signal: Trip Command
51R[2].DefaultSet	Signal: Default Parameter Set
51R[2].AdaptSet 1	Signal: Adaptive Parameter 1
51R[2].AdaptSet 2	Signal: Adaptive Parameter 2
51R[2].AdaptSet 3	Signal: Adaptive Parameter 3
51R[2].AdaptSet 4	Signal: Adaptive Parameter 4
51R[2].ExBlo1-I	Module Input State: External Blocking1
51R[2].ExBlo2-I	Module Input State: External Blocking2
51R[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
51R[2].Rvs Blo-I	Module Input State: Reverse Blocking
51R[2].AdaptSet1-I	Module Input State: Adaptive Parameter1
51R[2].AdaptSet2-I	Module Input State: Adaptive Parameter2
51R[2].AdaptSet3-I	Module Input State: Adaptive Parameter3
51R[2].AdaptSet4-I	Module Input State: Adaptive Parameter4
27M[1].Active	Signal: Active
27M[1].ExBlo	Signal: External Blocking
27M[1].Blo TripCmd	Signal: Trip Command blocked
27M[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
27M[1].Pickup Phase A	Signal: Pickup Phase A
27M[1].Pickup Phase B	Signal: Pickup Phase B
27M[1].Pickup Phase C	Signal: Pickup Phase C
27M[1].Pickup	Signal: Pickup Voltage Element
27M[1].Trip Phase A	Signal: General Trip Phase A
27M[1].Trip Phase B	Signal: General Trip Phase B
27M[1].Trip Phase C	Signal: General Trip Phase C
27M[1].Trip	Signal: Trip
27M[1].TripCmd	Signal: Trip Command
27M[1].ExBlo1-I	Module Input State: External Blocking1
27M[1].ExBlo2-I	Module Input State: External Blocking2
27M[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
27M[2].Active	Signal: Active
27M[2].ExBlo	Signal: External Blocking
27M[2].Blo TripCmd	Signal: Trip Command blocked
27M[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
27M[2].Pickup Phase A	Signal: Pickup Phase A
27M[2].Pickup Phase B	Signal: Pickup Phase B
27M[2].Pickup Phase C	Signal: Pickup Phase C
27M[2].Pickup	Signal: Pickup Voltage Element

Name	*Description*
27M[2].Trip Phase A	Signal: General Trip Phase A
27M[2].Trip Phase B	Signal: General Trip Phase B
27M[2].Trip Phase C	Signal: General Trip Phase C
27M[2].Trip	Signal: Trip
27M[2].TripCmd	Signal: Trip Command
27M[2].ExBlo1-I	Module Input State: External Blocking1
27M[2].ExBlo2-I	Module Input State: External Blocking2
27M[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
59M[1].Active	Signal: Active
59M[1].ExBlo	Signal: External Blocking
59M[1].Blo TripCmd	Signal: Trip Command blocked
59M[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
59M[1].Pickup Phase A	Signal: Pickup Phase A
59M[1].Pickup Phase B	Signal: Pickup Phase B
59M[1].Pickup Phase C	Signal: Pickup Phase C
59M[1].Pickup	Signal: Pickup Voltage Element
59M[1].Trip Phase A	Signal: General Trip Phase A
59M[1].Trip Phase B	Signal: General Trip Phase B
59M[1].Trip Phase C	Signal: General Trip Phase C
59M[1].Trip	Signal: Trip
59M[1].TripCmd	Signal: Trip Command
59M[1].ExBlo1-I	Module Input State: External Blocking1
59M[1].ExBlo2-I	Module Input State: External Blocking2
59M[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
59M[2].Active	Signal: Active
59M[2].ExBlo	Signal: External Blocking
59M[2].Blo TripCmd	Signal: Trip Command blocked
59M[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
59M[2].Pickup Phase A	Signal: Pickup Phase A
59M[2].Pickup Phase B	Signal: Pickup Phase B
59M[2].Pickup Phase C	Signal: Pickup Phase C
59M[2].Pickup	Signal: Pickup Voltage Element
59M[2].Trip Phase A	Signal: General Trip Phase A
59M[2].Trip Phase B	Signal: General Trip Phase B
59M[2].Trip Phase C	Signal: General Trip Phase C
59M[2].Trip	Signal: Trip
59M[2].TripCmd	Signal: Trip Command
59M[2].ExBlo1-I	Module Input State: External Blocking1
59M[2].ExBlo2-I	Module Input State: External Blocking2

Name	*Description*
59M[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
27A[1].Active	Signal: Active
27A[1].ExBlo	Signal: External Blocking
27A[1].Blo TripCmd	Signal: Trip Command blocked
27A[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
27A[1].Pickup	Signal: Pickup Residual Voltage Supervision-Element
27A[1].Trip	Signal: Trip
27A[1].TripCmd	Signal: Trip Command
27A[1].ExBlo1-I	Module Input State: External Blocking1
27A[1].ExBlo2-I	Module Input State: External Blocking2
27A[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
27A[2].Active	Signal: Active
27A[2].ExBlo	Signal: External Blocking
27A[2].Blo TripCmd	Signal: Trip Command blocked
27A[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
27A[2].Pickup	Signal: Pickup Residual Voltage Supervision-Element
27A[2].Trip	Signal: Trip
27A[2].TripCmd	Signal: Trip Command
27A[2].ExBlo1-I	Module Input State: External Blocking1
27A[2].ExBlo2-I	Module Input State: External Blocking2
27A[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
59A[1].Active	Signal: Active
59A[1].ExBlo	Signal: External Blocking
59A[1].Blo TripCmd	Signal: Trip Command blocked
59A[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
59A[1].Pickup	Signal: Pickup Residual Voltage Supervision-Element
59A[1].Trip	Signal: Trip
59A[1].TripCmd	Signal: Trip Command
59A[1].ExBlo1-I	Module Input State: External Blocking1
59A[1].ExBlo2-I	Module Input State: External Blocking2
59A[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
59A[2].Active	Signal: Active
59A[2].ExBlo	Signal: External Blocking
59A[2].Blo TripCmd	Signal: Trip Command blocked
59A[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
59A[2].Pickup	Signal: Pickup Residual Voltage Supervision-Element
59A[2].Trip	Signal: Trip
59A[2].TripCmd	Signal: Trip Command

Name	*Description*
59A[2].ExBlo1-I	Module Input State: External Blocking1
59A[2].ExBlo2-I	Module Input State: External Blocking2
59A[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
59N[1].Active	Signal: Active
59N[1].ExBlo	Signal: External Blocking
59N[1].Blo TripCmd	Signal: Trip Command blocked
59N[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
59N[1].Pickup	Signal: Pickup Residual Voltage Supervision-Element
59N[1].Trip	Signal: Trip
59N[1].TripCmd	Signal: Trip Command
59N[1].ExBlo1-I	Module Input State: External Blocking1
59N[1].ExBlo2-I	Module Input State: External Blocking2
59N[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
59N[2].Active	Signal: Active
59N[2].ExBlo	Signal: External Blocking
59N[2].Blo TripCmd	Signal: Trip Command blocked
59N[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
59N[2].Pickup	Signal: Pickup Residual Voltage Supervision-Element
59N[2].Trip	Signal: Trip
59N[2].TripCmd	Signal: Trip Command
59N[2].ExBlo1-I	Module Input State: External Blocking1
59N[2].ExBlo2-I	Module Input State: External Blocking2
59N[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
46[1].Active	Signal: Active
46[1].ExBlo	Signal: External Blocking
46[1].Blo TripCmd	Signal: Trip Command blocked
46[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
46[1].Pickup	Signal: Pickup Negative Sequence
46[1].Trip	Signal: Trip
46[1].TripCmd	Signal: Trip Command
46[1].ExBlo1-I	Module Input State: External Blocking1
46[1].ExBlo2-I	Module Input State: External Blocking2
46[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
46[2].Active	Signal: Active
46[2].ExBlo	Signal: External Blocking
46[2].Blo TripCmd	Signal: Trip Command blocked
46[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
46[2].Pickup	Signal: Pickup Negative Sequence

Name	*Description*
46[2].Trip	Signal: Trip
46[2].TripCmd	Signal: Trip Command
46[2].ExBlo1-I	Module Input State: External Blocking1
46[2].ExBlo2-I	Module Input State: External Blocking2
46[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
47[1].Active	Signal: Active
47[1].ExBlo	Signal: External Blocking
47[1].Blo TripCmd	Signal: Trip Command blocked
47[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
47[1].Pickup	Signal: Pickup Voltage Asymmetry
47[1].Trip	Signal: Trip
47[1].TripCmd	Signal: Trip Command
47[1].ExBlo1-I	Module Input State: External Blocking1
47[1].ExBlo2-I	Module Input State: External Blocking2
47[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
47[2].Active	Signal: Active
47[2].ExBlo	Signal: External Blocking
47[2].Blo TripCmd	Signal: Trip Command blocked
47[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
47[2].Pickup	Signal: Pickup Voltage Asymmetry
47[2].Trip	Signal: Trip
47[2].TripCmd	Signal: Trip Command
47[2].ExBlo1-I	Module Input State: External Blocking1
47[2].ExBlo2-I	Module Input State: External Blocking2
47[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
81[1].Active	Signal: Active
81[1].ExBlo	Signal: External Blocking
81[1].Blo by V<	Signal: Module is blocked by undervoltage.
81[1].Blo TripCmd	Signal: Trip Command blocked
81[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
81[1].Pickup 81	Signal: Pickup Frequency Protection
81[1].Pickup df/dt | DF/DT	Pickup instantaneous or average value of the rate-of-frequency-change
81[1].Pickup Vector Surge	Signal: Pickup Vector Surge
81[1].Pickup	Signal: Pickup Frequency Protection (collective signal)
81[1].Trip 81	Signal: Frequency has exceeded the limit.
81[1].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
81[1].Trip Vector Surge	Signal: Trip delta phi
81[1].Trip	Signal: Trip Frequency Protection (collective signal)

Name	*Description*
81[1].TripCmd	Signal: Trip Command
81[1].ExBlo1-I	Module Input State: External Blocking1
81[1].ExBlo2-I	Module Input State: External Blocking2
81[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
81[2].Active	Signal: Active
81[2].ExBlo	Signal: External Blocking
81[2].Blo by V<	Signal: Module is blocked by undervoltage.
81[2].Blo TripCmd	Signal: Trip Command blocked
81[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
81[2].Pickup 81	Signal: Pickup Frequency Protection
81[2].Pickup df/dt | DF/DT	Pickup instantaneous or average value of the rate-of-frequency-change
81[2].Pickup Vector Surge	Signal: Pickup Vector Surge
81[2].Pickup	Signal: Pickup Frequency Protection (collective signal)
81[2].Trip 81	Signal: Frequency has exceeded the limit.
81[2].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
81[2].Trip Vector Surge	Signal: Trip delta phi
81[2].Trip	Signal: Trip Frequency Protection (collective signal)
81[2].TripCmd	Signal: Trip Command
81[2].ExBlo1-I	Module Input State: External Blocking1
81[2].ExBlo2-I	Module Input State: External Blocking2
81[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
81[3].Active	Signal: Active
81[3].ExBlo	Signal: External Blocking
81[3].Blo by V<	Signal: Module is blocked by undervoltage.
81[3].Blo TripCmd	Signal: Trip Command blocked
81[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
81[3].Pickup 81	Signal: Pickup Frequency Protection
81[3].Pickup df/dt | DF/DT	Pickup instantaneous or average value of the rate-of-frequency-change
81[3].Pickup Vector Surge	Signal: Pickup Vector Surge
81[3].Pickup	Signal: Pickup Frequency Protection (collective signal)
81[3].Trip 81	Signal: Frequency has exceeded the limit.
81[3].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
81[3].Trip Vector Surge	Signal: Trip delta phi
81[3].Trip	Signal: Trip Frequency Protection (collective signal)
81[3].TripCmd	Signal: Trip Command
81[3].ExBlo1-I	Module Input State: External Blocking1
81[3].ExBlo2-I	Module Input State: External Blocking2

Name	Description
81[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
81[4].Active	Signal: Active
81[4].ExBlo	Signal: External Blocking
81[4].Blo by V<	Signal: Module is blocked by undervoltage.
81[4].Blo TripCmd	Signal: Trip Command blocked
81[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
81[4].Pickup 81	Signal: Pickup Frequency Protection
81[4].Pickup df/dt | DF/DT	Pickup instantaneous or average value of the rate-of-frequency-change
81[4].Pickup Vector Surge	Signal: Pickup Vector Surge
81[4].Pickup	Signal: Pickup Frequency Protection (collective signal)
81[4].Trip 81	Signal: Frequency has exceeded the limit.
81[4].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
81[4].Trip Vector Surge	Signal: Trip delta phi
81[4].Trip	Signal: Trip Frequency Protection (collective signal)
81[4].TripCmd	Signal: Trip Command
81[4].ExBlo1-I	Module Input State: External Blocking1
81[4].ExBlo2-I	Module Input State: External Blocking2
81[4].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
81[5].Active	Signal: Active
81[5].ExBlo	Signal: External Blocking
81[5].Blo by V<	Signal: Module is blocked by undervoltage.
81[5].Blo TripCmd	Signal: Trip Command blocked
81[5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
81[5].Pickup 81	Signal: Pickup Frequency Protection
81[5].Pickup df/dt | DF/DT	Pickup instantaneous or average value of the rate-of-frequency-change
81[5].Pickup Vector Surge	Signal: Pickup Vector Surge
81[5].Pickup	Signal: Pickup Frequency Protection (collective signal)
81[5].Trip 81	Signal: Frequency has exceeded the limit.
81[5].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
81[5].Trip Vector Surge	Signal: Trip delta phi
81[5].Trip	Signal: Trip Frequency Protection (collective signal)
81[5].TripCmd	Signal: Trip Command
81[5].ExBlo1-I	Module Input State: External Blocking1
81[5].ExBlo2-I	Module Input State: External Blocking2
81[5].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
81[6].Active	Signal: Active
81[6].ExBlo	Signal: External Blocking

Name	*Description*
81[6].Blo by V<	Signal: Module is blocked by undervoltage.
81[6].Blo TripCmd	Signal: Trip Command blocked
81[6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
81[6].Pickup 81	Signal: Pickup Frequency Protection
81[6].Pickup df/dt | DF/DT	Pickup instantaneous or average value of the rate-of-frequency-change
81[6].Pickup Vector Surge	Signal: Pickup Vector Surge
81[6].Pickup	Signal: Pickup Frequency Protection (collective signal)
81[6].Trip 81	Signal: Frequency has exceeded the limit.
81[6].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
81[6].Trip Vector Surge	Signal: Trip delta phi
81[6].Trip	Signal: Trip Frequency Protection (collective signal)
81[6].TripCmd	Signal: Trip Command
81[6].ExBlo1-I	Module Input State: External Blocking1
81[6].ExBlo2-I	Module Input State: External Blocking2
81[6].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
PF-55D[1].Active	Signal: Active
PF-55D[1].ExBlo	Signal: External Blocking
PF-55D[1].Blo TripCmd	Signal: Trip Command blocked
PF-55D[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PF-55D[1].Pickup	Signal: Pickup Power Factor
PF-55D[1].Trip	Signal: Trip Power Factor
PF-55D[1].TripCmd	Signal: Trip Command
PF-55D[1].Compensator	Signal: Compensation Signal
PF-55D[1].Impossible	Signal: Pickup Power Factor Impossible
PF-55D[1].ExBlo1-I	Module Input State: External Blocking
PF-55D[1].ExBlo2-I	Module Input State: External Blocking
PF-55D[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
PF-55D[2].Active	Signal: Active
PF-55D[2].ExBlo	Signal: External Blocking
PF-55D[2].Blo TripCmd	Signal: Trip Command blocked
PF-55D[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PF-55D[2].Pickup	Signal: Pickup Power Factor
PF-55D[2].Trip	Signal: Trip Power Factor
PF-55D[2].TripCmd	Signal: Trip Command
PF-55D[2].Compensator	Signal: Compensation Signal
PF-55D[2].Impossible	Signal: Pickup Power Factor Impossible
PF-55D[2].ExBlo1-I	Module Input State: External Blocking
PF-55D[2].ExBlo2-I	Module Input State: External Blocking

Name	*Description*
PF-55D[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
PF-55A[1].Active	Signal: Active
PF-55A[1].ExBlo	Signal: External Blocking
PF-55A[1].Blo TripCmd	Signal: Trip Command blocked
PF-55A[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PF-55A[1].Pickup	Signal: Pickup Power Factor
PF-55A[1].Trip	Signal: Trip Power Factor
PF-55A[1].TripCmd	Signal: Trip Command
PF-55A[1].Compensator	Signal: Compensation Signal
PF-55A[1].Impossible	Signal: Pickup Power Factor Impossible
PF-55A[1].ExBlo1-I	Module Input State: External Blocking
PF-55A[1].ExBlo2-I	Module Input State: External Blocking
PF-55A[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
PF-55A[2].Active	Signal: Active
PF-55A[2].ExBlo	Signal: External Blocking
PF-55A[2].Blo TripCmd	Signal: Trip Command blocked
PF-55A[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PF-55A[2].Pickup	Signal: Pickup Power Factor
PF-55A[2].Trip	Signal: Trip Power Factor
PF-55A[2].TripCmd	Signal: Trip Command
PF-55A[2].Compensator	Signal: Compensation Signal
PF-55A[2].Impossible	Signal: Pickup Power Factor Impossible
PF-55A[2].ExBlo1-I	Module Input State: External Blocking
PF-55A[2].ExBlo2-I	Module Input State: External Blocking
PF-55A[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ZI.Active	Signal: Active
ZI.ExBlo	Signal: External Blocking
ZI.Blo TripCmd	Signal: Trip Command blocked
ZI.ExBlo TripCmd	Signal: External Blocking of the Trip Command
ZI.Bkr Blo	Signal: Blocked by Breaker Failure
ZI.Phase Pickup	Signal: Zone Interlocking Phase Pickup
ZI.Phase Trip	Signal: Zone Interlocking Phase Trip
ZI.Ground Pickup	Signal: Zone Interlocking Ground Pickup
ZI.Ground Trip	Signal: Zone Interlocking Ground Trip
ZI.Pickup	Signal: Pickup Zone Interlocking
ZI.Trip	Signal: Zone Interlocking Trip
ZI.TripCmd	Signal: Zone Interlocking Trip Command
ZI.Phase OUT	Signal: Zone Interlocking Phase OUT
ZI.Ground OUT	Signal: Zone Interlocking Ground OUT

Name	*Description*
ZI.OUT	Signal: Zone Interlocking OUT
ZI.IN	Signal: Zone Interlocking IN
ZI.ExBlo1-I	Module Input State: External Blocking1
ZI.ExBlo2-I	Module Input State: External Blocking2
ZI.ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ZI.Bkr Blo-I	Signal: Blocked by Breaker Failure
SOTF.Active	Signal: Active
SOTF.ExBlo	Signal: External Blocking
SOTF.Rvs Blo	Signal: Reverse Blocking
SOTF.enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
SOTF.I<	Signal: No Load Current.
SOTF.ExBlo1-I	Module Input State: External Blocking
SOTF.ExBlo2-I	Module Input State: External Blocking
SOTF.Rvs Blo-I	Module Input State: Reverse Blocking
SOTF.Ex Manual CLOSE CMD-I	Module Input State: External manual breaker CLOSE command (NOT for AR!)
SOTF.Ext SOTF-I	Module Input State: External Switch Onto Fault Alarm
CLPU.Active	Signal: Active
CLPU.ExBlo	Signal: External Blocking
CLPU.Rvs Blo	Signal: Reverse Blocking
CLPU.enabled	Signal: Cold Load enabled
CLPU.detected	Signal: Cold Load detected
CLPU.I<	Signal: No Load Current.
CLPU.Load Inrush	Signal: Load Inrush
CLPU.Settle Time	Signal: Settle Time
CLPU.ExBlo1-I	Module Input State: External Blocking
CLPU.ExBlo2-I	Module Input State: External Blocking
CLPU.Rvs Blo-I	Module Input State: Reverse Blocking
ExP[1].Active	Signal: Active
ExP[1].ExBlo	Signal: External Blocking
ExP[1].Blo TripCmd	Signal: Trip Command blocked
ExP[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[1].Alarm	Signal: Alarm
ExP[1].Trip	Signal: Trip
ExP[1].TripCmd	Signal: Trip Command
ExP[1].ExBlo1-I	Module Input State: External Blocking1
ExP[1].ExBlo2-I	Module Input State: External Blocking2
ExP[1].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[1].Alarm-I	Module Input State: Alarm

Name	*Description*
ExP[1].Trip-I	Module Input State: Trip
ExP[2].Active	Signal: Active
ExP[2].ExBlo	Signal: External Blocking
ExP[2].Blo TripCmd	Signal: Trip Command blocked
ExP[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[2].Alarm	Signal: Alarm
ExP[2].Trip	Signal: Trip
ExP[2].TripCmd	Signal: Trip Command
ExP[2].ExBlo1-I	Module Input State: External Blocking1
ExP[2].ExBlo2-I	Module Input State: External Blocking2
ExP[2].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[2].Alarm-I	Module Input State: Alarm
ExP[2].Trip-I	Module Input State: Trip
ExP[3].Active	Signal: Active
ExP[3].ExBlo	Signal: External Blocking
ExP[3].Blo TripCmd	Signal: Trip Command blocked
ExP[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[3].Alarm	Signal: Alarm
ExP[3].Trip	Signal: Trip
ExP[3].TripCmd	Signal: Trip Command
ExP[3].ExBlo1-I	Module Input State: External Blocking1
ExP[3].ExBlo2-I	Module Input State: External Blocking2
ExP[3].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[3].Alarm-I	Module Input State: Alarm
ExP[3].Trip-I	Module Input State: Trip
ExP[4].Active	Signal: Active
ExP[4].ExBlo	Signal: External Blocking
ExP[4].Blo TripCmd	Signal: Trip Command blocked
ExP[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[4].Alarm	Signal: Alarm
ExP[4].Trip	Signal: Trip
ExP[4].TripCmd	Signal: Trip Command
ExP[4].ExBlo1-I	Module Input State: External Blocking1
ExP[4].ExBlo2-I	Module Input State: External Blocking2
ExP[4].ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command
ExP[4].Alarm-I	Module Input State: Alarm
ExP[4].Trip-I	Module Input State: Trip
BF.Active	Signal: Active
BF.ExBlo	Signal: External Blocking

Name	*Description*
BF.Pickup	Signal: BF-Module Started (Pickup)
BF.Trip	Signal: Breaker Failure Trip
BF.ExBlo1-I	Module Input State: External Blocking1
BF.ExBlo2-I	Module Input State: External Blocking2
BF.Trigger1	Module Input: Trigger that will start the BF
BF.Trigger2	Module Input: Trigger that will start the BF
BF.Trigger3	Module Input: Trigger that will start the BF
TCM.Active	Signal: Active
TCM.ExBlo	Signal: External Blocking
TCM.Pickup	Signal: Pickup Trip Circuit Supervision
TCM.Not Possible	Not possible because no state indicator assigned to the breaker.
TCM.CinBkr-52a	Position indicator/check-back signal of the Bkr (52a)
TCM.CinBkr-52b	Module Input State: Position indicator/check-back signal of the Bkr. (52b)
TCM.ExBlo1-I	Module Input State: External Blocking1
TCM.ExBlo2-I	Module Input State: External Blocking2
CTS.Active	Signal: Active
CTS.ExBlo	Signal: External Blocking
CTS.Pickup	Signal: Pickup Current Transformer Measuring Circuit Supervision
CTS.ExBlo1-I	Module Input State: External Blocking1
CTS.ExBlo2-I	Module Input State: External Blocking2
LOP.Active	Signal: Active
LOP.ExBlo	Signal: External Blocking
LOP.Pickup	Signal: Pickup Loss of Potential
LOP.LOP Blo	Signal: Loss of Potential blocks other elements
LOP.ExBlo1-I	Module Input State: External Blocking1
LOP.ExBlo2-I	Module Input State: External Blocking2
DI-8P X1.DI 1	Signal: Digital Input
DI-8P X1.DI 2	Signal: Digital Input
DI-8P X1.DI 3	Signal: Digital Input
DI-8P X1.DI 4	Signal: Digital Input
DI-8P X1.DI 5	Signal: Digital Input
DI-8P X1.DI 6	Signal: Digital Input
DI-8P X1.DI 7	Signal: Digital Input
DI-8P X1.DI 8	Signal: Digital Input
RO-6 X5.RO 1	Signal: Relay Output
RO-6 X5.RO 2	Signal: Relay Output
RO-6 X5.RO 3	Signal: Relay Output
RO-6 X5.RO 4	Signal: Relay Output
RO-6 X5.RO 5	Signal: Relay Output

Name	*Description*
RO-6 X5.RO 6	Signal: Relay Output
RO-6 X5.DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
RO-6 X5.Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assined signals.
RO-4Z X2.ZI OUT	Signal: Zone Interlocking OUT
RO-4Z X2.RO 1	Signal: Relay Output
RO-4Z X2.RO 2	Signal: Relay Output
RO-4Z X2.RO 3	Signal: Relay Output
RO-4Z X2.RO 4	Signal: Relay Output
RO-4Z X2.DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
RO-4Z X2.Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assined signals.
Event rec.Reset all rec	Signal: All records deleted
Disturb rec.Recording	Signal: Recording
Disturb rec.Write err	Signal: Writing Error in Memory
Disturb rec.Memory full	Signal: Memory Full
Disturb rec.Clear fail	Signal: Clear Failure in Memory
Disturb rec.Reset all rec	Signal: All records deleted
Disturb rec.Reset record	Signal: Delete Record
Disturb rec.Man. Trigger	Signal: Manual Trigger
Disturb rec.Start1-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start2-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start3-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start4-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start5-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start6-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start7-I	State of the module input: Trigger event / start recording if:

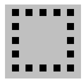
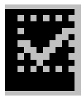
Name	*Description*
Disturb rec.Start8-I	State of the module input: Trigger event / start recording if:
Fault rec.Reset record	Signal: Delete Record
Fault rec.Man. Trigger	Signal: Manual Trigger
Fault rec.Start1-I	State of the module input: Trigger event / start recording if:
Fault rec.Start2-I	State of the module input: Trigger event / start recording if:
Fault rec.Start3-I	State of the module input: Trigger event / start recording if:
Fault rec.Start4-I	State of the module input: Trigger event / start recording if:
Fault rec.Start5-I	State of the module input: Trigger event / start recording if:
Fault rec.Start6-I	State of the module input: Trigger event / start recording if:
Fault rec.Start7-I	State of the module input: Trigger event / start recording if:
Fault rec.Start8-I	State of the module input: Trigger event / start recording if:
Modbus.Transmission	Signal: Communication Active
Modbus.Comm Cmd 1	Communication Command
Modbus.Comm Cmd 2	Communication Command
Modbus.Comm Cmd 3	Communication Command
Modbus.Comm Cmd 4	Communication Command
Modbus.Comm Cmd 5	Communication Command
Modbus.Comm Cmd 6	Communication Command
Modbus.Comm Cmd 7	Communication Command
Modbus.Comm Cmd 8	Communication Command
Modbus.Comm Cmd 9	Communication Command
Modbus.Comm Cmd 10	Communication Command
Modbus.Comm Cmd 11	Communication Command
Modbus.Comm Cmd 12	Communication Command
Modbus.Comm Cmd 13	Communication Command
Modbus.Comm Cmd 14	Communication Command
Modbus.Comm Cmd 15	Communication Command
Modbus.Comm Cmd 16	Communication Command
IRIG-B.Active	Signal: Active
IRIG-B.Inverted	Signal: IRIG-B inverted
IRIG-B.Control Signal1	Signal: IRIG-B Control Signal
IRIG-B.Control Signal2	Signal: IRIG-B Control Signal
IRIG-B.Control Signal4	Signal: IRIG-B Control Signal
IRIG-B.Control Signal5	Signal: IRIG-B Control Signal
IRIG-B.Control Signal6	Signal: IRIG-B Control Signal

Name	*Description*
IRIG-B.Control Signal7	Signal: IRIG-B Control Signal
IRIG-B.Control Signal8	Signal: IRIG-B Control Signal
IRIG-B.Control Signal9	Signal: IRIG-B Control Signal
IRIG-B.Control Signal10	Signal: IRIG-B Control Signal
IRIG-B.Control Signal11	Signal: IRIG-B Control Signal
IRIG-B.Control Signal12	Signal: IRIG-B Control Signal
IRIG-B.Control Signal13	Signal: IRIG-B Control Signal
IRIG-B.Control Signal14	Signal: IRIG-B Control Signal
IRIG-B.Control Signal15	Signal: IRIG-B Control Signal
IRIG-B.Control Signal16	Signal: IRIG-B Control Signal
IRIG-B.Control Signal17	Signal: IRIG-B Control Signal
IRIG-B.Control Signal18	Signal: IRIG-B Control Signal
Statistics.Reset	Signal: Reset of Statistics
Statistics.StartFct-I	Module input state: Start statistics Module input signal
Statistics.ResetFct-I	Module Input State: Reset Statistics Module input signal
Sys.PS 1	Signal: Parameter Set 1
Sys.PS 2	Signal: Parameter Set 2
Sys.PS 3	Signal: Parameter Set 3
Sys.PS 4	Signal: Parameter Set 4
Sys.PSS manual	Signal: Manual switch over of a Parameter Set
Sys.PSS via Comm	Signal: Parameter Set Switch via Communication
Sys.PSS via Inp fct	Signal: Parameter Set Switch via Input Function
Sys.Min. 1 param changed	Signal: At least one parameter has been changed
Sys.Maint Mode Active	Signal: Arc Flash Reduction Maintenance Active
Sys.Maint Mode Inactive	Signal: Arc Flash Reduction Maintenance Inactive
Sys.Maint Mode Manually	Signal: Arc Flash Reduction Maintenance Manual Mode
Sys.Maint Mode Comm	Signal: Arc Flash Reduction Maintenance Comm Mode
Sys.Maint Mode DI	Signal: Arc Flash Reduction Maintenance Digital Input Mode
Sys.Ack LED	Signal: LEDs Acknowledgment
Sys.Ack RO	Signal: Acknowledgment of the Relay Outputs
Sys.Ack Comm	Signal: Acknowledge Communication
Sys.Ack TripCmd	Signal: Reset Trip Command
Sys.Ack LED-HMI	Signal: LEDs Acknowledgment :HMI
Sys.Ack RO-HMI	Signal: Acknowledgment of the Relay Outputs :HMI
Sys.Ack Comm-HMI	Signal: Acknowledge Communication :HMI
Sys.Ack TripCmd-HMI	Signal: Reset Trip Command :HMI
Sys.Ack LED-Comm	Signal: LEDs Acknowledgment :Communication
Sys.Ack RO-Comm	Signal: Acknowledgment of the Relay Outputs :Communication

Name	*Description*
Sys.Ack Counter-Comm	Signal: Reset of all Counters :Communication
Sys.Ack Comm-Comm	Signal: Acknowledge Communication :Communication
Sys.Ack TripCmd-Comm	Signal: Reset Trip Command :Communication
Sys.Ack LED-I	Module Input State: LEDs Acknowledgment by Digital Input.
Sys.Ack RO-I	Module Input State: Acknowledgment of the Relay Outputs.
Sys.Ack Comm-I	Module Input State: Acknowledge Communication via Digital Input. The replica that Communication has received from the device is to be reset.
Sys.PS1-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS2-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS3-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS4-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.
Sys.Maint Mode-I	Module Input State: Arc Flash Reduction Maintenance Switch

Status Display

In the status display within the »Operation« menu, the present state of all signals of the »ASSIGNMENT LIST« can be viewed. This means the User is able to see if the individual signals are active or inactive at that moment. The User can choose whether to see all signals in an overall status or view the signals sorted by modules.

State of the Module Input / Signal Is...	*Is Shown at the Panel as...*
false / »0«	
true / »1«	

Status Display via PowerPort E

•If PowerPort E is not running, please start the application.

•If the device data have not been downloaded recently, select »Receive Data From The Device« from »Device« menu.

•Double click on the »Operation« icon in the navigation tree.

•Double click on the »Status Display« icon within the operational data.

•Double click the »Overall status« i to see all signals at once or call up a specific module to see the states.

•The User can see the state of all corresponding signals on the window.

NOTICE **To have the status display updated in a cyclic manner, select »Automatic Up-Date« in the »*VIEW*« menu.**

State of the Module Input / Signal Is...	*Is Shown in PowerPort-E as...*
false / »0«	0
true / »1«	1
No connection to the device	?

Operating Panel (HMI)

HMI

Special Parameters of the Panel

The »Device Parameter/HMI« menu is used to define the contrast of the display, the maximum admissible edit time, and the menu language (after expiration, all unsaved parameter changes will be rejected).

Direct Commands of the Panel

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Contrast	Contrast	30 - 60	50	[Device Para /HMI]

Global Protection Parameters of the Panel

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-max Edit	If no other key(s) is pressed at the panel, after expiration of this time, all cached (changed) parameters are cancelled.	20 - 3600s	180s	[Device Para /HMI]

Module: Disturbance Recorder

Disturb rec

The disturbance recorder works with 32 samples per cycle. It can be started by one of eight start events (selection from the »Assignment list«/OR-Logic).

The disturbance record contains the measuring values including the pre-trigger time. By means of PowerPort-E/ *Quality Manager* (option), the oscillographic curves of the analog (current, voltage) and digital channels/traces can be shown and evaluated in a graphical form.

The disturbance recorder has a storage capacity of 120 s (duration). The amount of records depends on the file size of each record.

The disturbance recorder can be configured in the*»Device Parameter/Recorder/Disturb rec«* menu.

Determine the maximum recording time to register a disturbance event. The maximum total length of a recording is
10 s (including pre-trigger and post-trigger time).

To trigger the disturbance recorder, up to eight signals can be selected from the »Assignment list«. The trigger events are OR-linked. If a disturbance record is written, a new disturbance record cannot be triggered until all trigger signals, which have triggered the previous disturbance record, are gone.

Recording is only done for the time the assigned event exists (event controlled), plus the time for the pre- and post-trigger, but not longer than 10 s. The time for the pre- and post-trigger is to be entered as percent of the maximum file size.

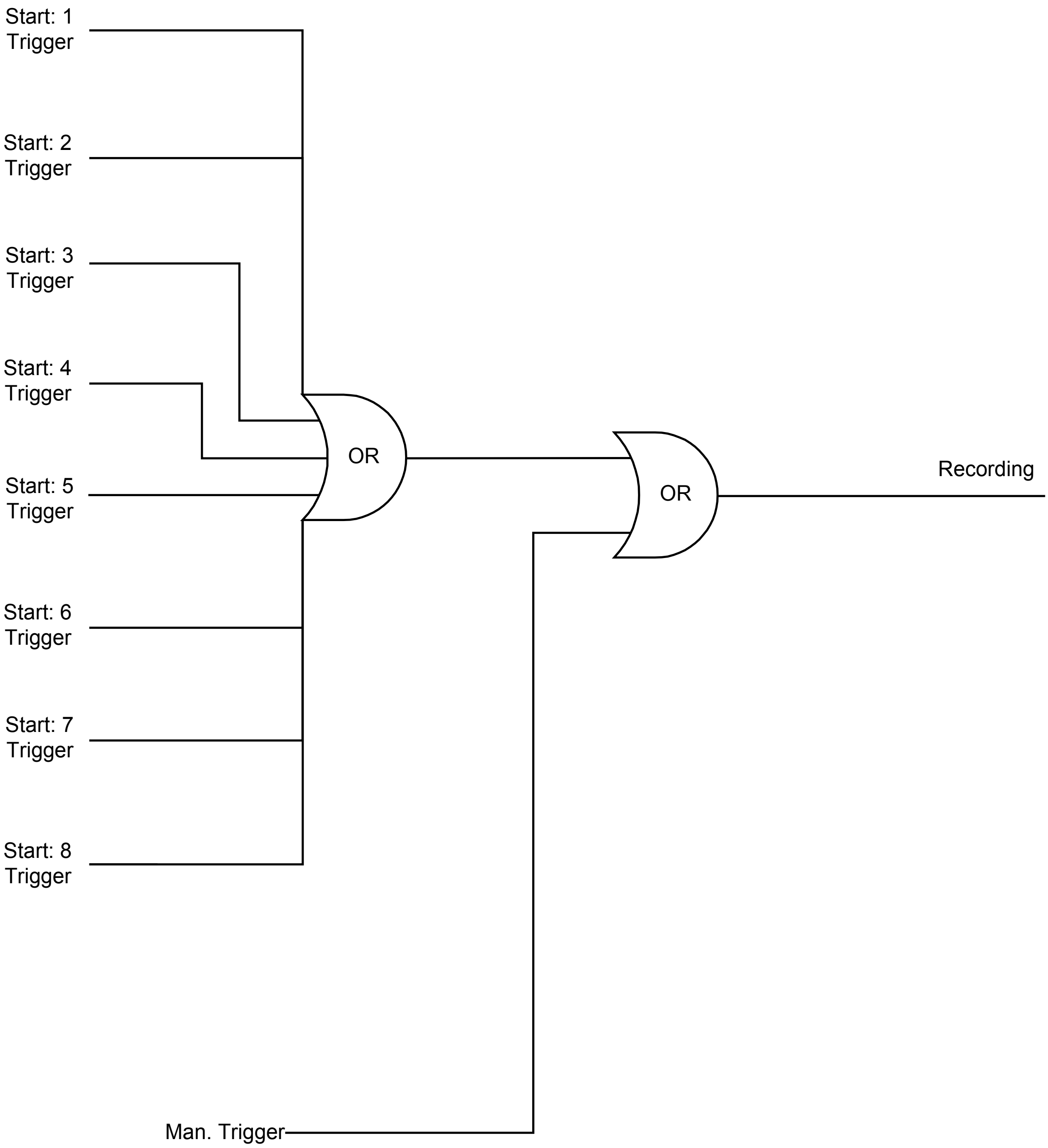
NOTICE

The post-trigger time will be up to the "Post-trigger time" depending on the duration of the trigger signal. The post-trigger will be the remaining time of the "Max file size" but, at maximum, the "Post-trigger time".

Example

The disturbance recorder is started by the general activation facility. After the fault has been cleared (plus follow-up time), the recording process is stopped (but after 10 s at the latest).

The parameter *»Auto Delete«* defines how the device will react if a location to which to save the disturbance record is not available. In case *»Auto Delete«* is *»Active«*, the first recorded disturbance will be overwritten according to the FIFO principle. If the parameter is set to *»Inactive«*, recording of the disturbance events will be stopped until the storage location is manually released.


Start: 1
Trigger
Start: 2
Trigger
Start: 3
Trigger
Start: 4
Trigger
Start: 5
Trigger
Start: 6
Trigger
Start: 7
Trigger
Start: 8
Trigger
OR
OR
Recording
Man. Trigger

Start 1 = Prot.Pickup

Start 2 = -.-

Start 3 = -.-

Start 4 = -.-

Start 5 = -.-

Start 6 = -.-

Start 7 = -.-

Start 8 = -.-

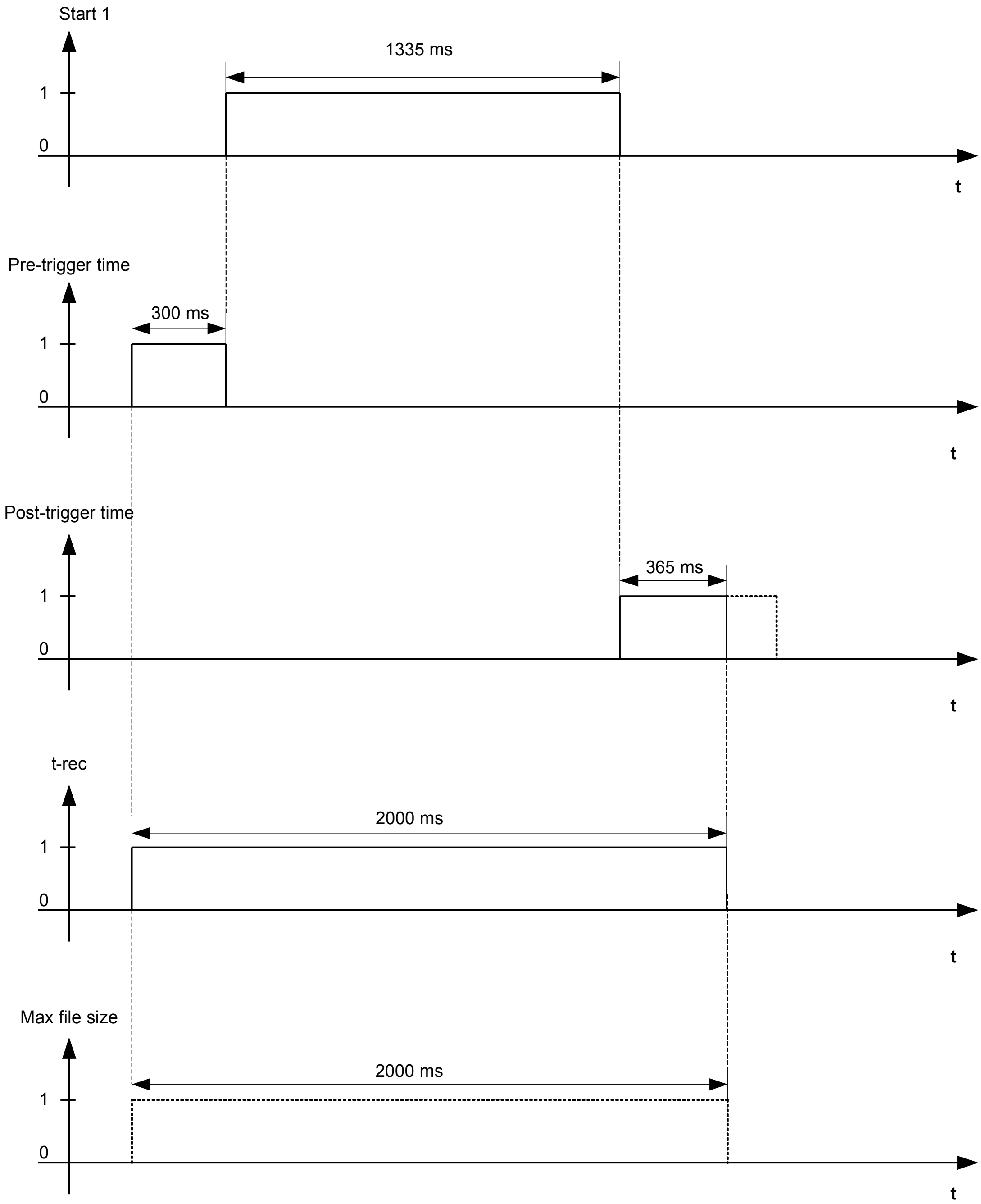
Auto overwriting = Active

Post-trigger time = 25%

Pre-trigger time = 15%

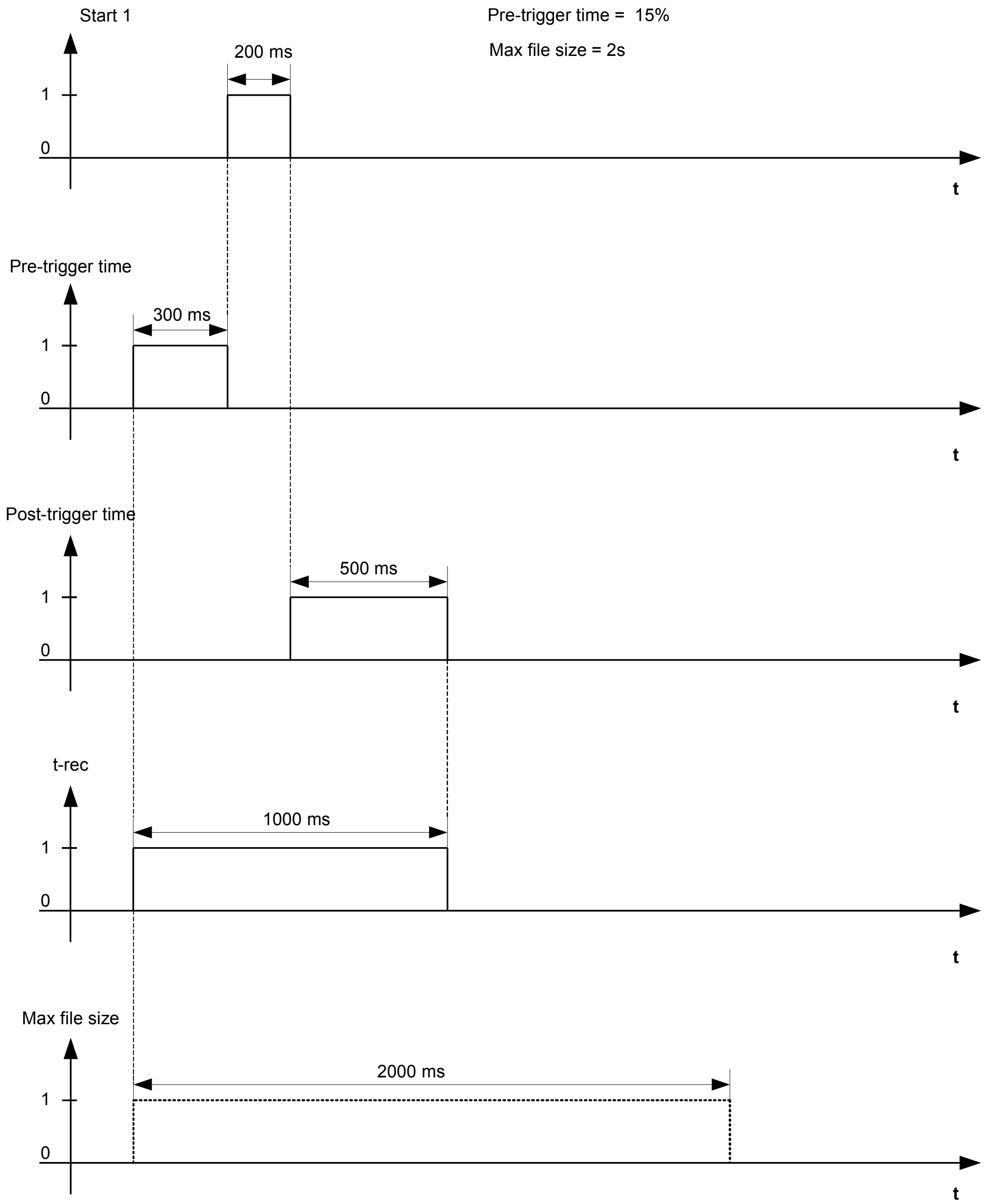
Max file size = 2s

t-rec = Max file size



Start 1 = Prot.Trip
Start 2 = -.-
Start 3 = -.-
Start 4 = -.-
Start 5 = -.-
Start 6 = -.-
Start 7 = -.-
Start 8 = -.-
Auto overwriting = Active
Post-trigger time = 25%
Pre-trigger time = 15%
Max file size = 2s

t-rec < Max file size



Read Out of Disturbance Records

Within the »Operation/Disturb rec« menu, the User can:

•Detect the accumulated disturbance records.

NOTICE **Within the »Operation/Recorders/Man Trigger« menu, the User can trigger the disturbance recorder manually.**

To Read Out the Disturbance Recorder with PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Recorders« icon in the navigation tree.
- Double click the »Disturb rec« icon.
- In the window, the disturbance records are shown in tabular form.
- A pop-up will appear by double clicking on a disturbance record. Choose a folder where the disturbance record is to be saved.
- The User can analyze the disturbance records by means of the optionally available *Quality Manager* by clicking on »Yes« when asked “Shall the received disturbance record be opened by the *Quality Manager?"*

Deleting Disturbance Records

Within the »Operation/Disturb rec« menu, the User can:

•Delete disturbance records;

•Choose the disturbance record that is to be deleted via »SOFTKEY« »up« and »SOFTKEY« »down«;

•Call up the detailed view of the disturbance record via »SOFTKEY« »right«;

•Confirm by pressing »SOFTKEY« »delete«;

•Enter the User password followed by pressing the »OK« key;

•Choose whether only the current or all disturbance records should be deleted; and

•Confirm by pressing »SOFTKEY« »OK«.

Deleting Disturbance Records Via PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Recorders« icon in the navigation tree.
- Double click the »Disturb rec« icon.
- In the window, the disturbance records are shown in tabular form.
- In order to delete a disturbance record, double click on

  (the red x) in front of the disturbance record and confirm.

Direct Commands of the Disturbance Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Man. Trigger	Manual Trigger	False, True	False	[Operation /Recorders /Man. Trigger]
Reset all rec	Reset all records	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Disturbance Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Prot.Pickup	[Device Para /Recorders /Disturb rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start: 8	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Disturb rec]
Auto overwriting	If there is no more free memory capacity left, the oldest file will be overwritten.	Inactive, Active	Active	[Device Para /Recorders /Disturb rec]
Post-trigger time	The post-trigger time will be up to "Post-trigger time" depending on the duration of the trigger signal. The post-trigger will be the remaining time of the "Max file size" but at maximum "Post-trigger time"	0 - 50%	20%	[Device Para /Recorders /Disturb rec]
Pre-trigger time	The pre-trigger time will always be "Pre-trigger time" of the "Max file size".	0 - 50%	20%	[Device Para /Recorders /Disturb rec]
Max file size	The maximum storage capacity per record is 10 seconds, including pre-trigger and post-trigger time. The disturbance recorder has a total storage capacity of 120 seconds.	0.1 - 10.0s	2s	[Device Para /Recorders /Disturb rec]

Disturbance Recorder Module Input States

Name	*Description*	*Assignment Via*
Start1-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start2-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start3-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start4-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start5-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start6-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start7-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start8-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]

Disturbance Recorder Module Signals

Name	*Description*
Recording	Signal: Recording
Write err	Signal: Writing Error in Memory
Memory full	Signal: Memory Full
Clear fail	Signal: Clear Failure in Memory
Reset all rec	Signal: All records deleted
Reset record	Signal: Delete Record
Man. Trigger	Signal: Manual Trigger

Special Parameters of the Disturbance Recorder

Value	*Description*	*Default*	*Size*	*Menu Path*
Rec state	Recording state	Ready	Ready, Recording, Writing file, Trigger Blo	[Operation /Status display /Disturb rec]
Error code	Error code	OK	OK, Write err, Clear fail, Calculation err, File not found, Auto overwriting off	[Operation /Status display /Disturb rec]

Module: Fault Recorder

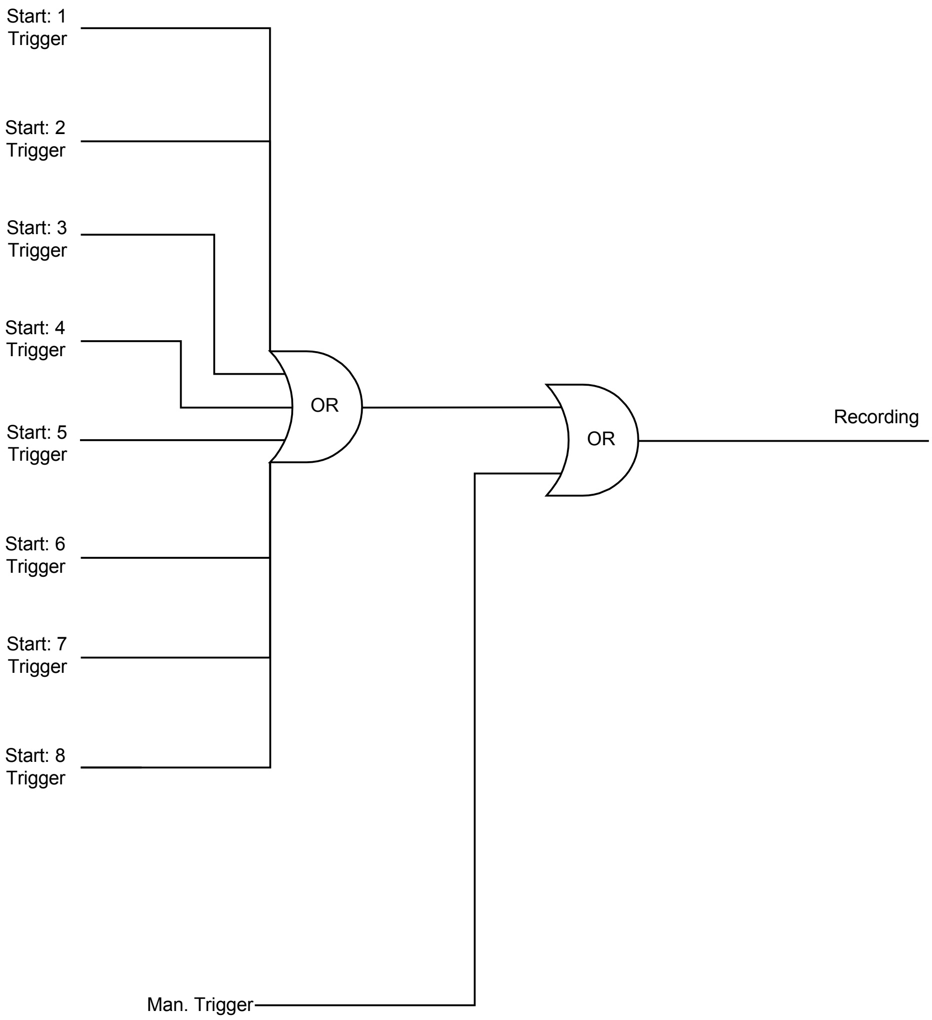
Fault rec

The fault recorder can be started by one of eight start events (selection from the »Assignment list«/OR-Logic). It can register up to 20 faults. The last of the recorded faults is stored in a fail-safe manner.

If one of the assigned trigger events becomes true, the fault recorder will be started. When a trigger event happens, each fault is saved including the module and name, fault number, number of grid faults and record number at that time. For each of the faults, the measuring values (at the time when the trigger event became true) can be viewed.

Up to eight signals to trigger the fault recorder can be selected from the »Assignment list«. The trigger events are OR-linked.

The parameter *»Auto Delete«* defines how the device will react if there is no saving place available. In case *»Auto Delete«* is *»Active«*, the first recorded fault will be overwritten according to the FIFO principle. If the parameter is set to *»Inactive«*, recording of the fault events will be stopped until the storage location is released manually.



Read Out the Fault Recorder

The measured values at the time of tripping are saved (fail-safe) within the fault recorder. If there is no more memory free, the oldest record will be overwritten (FIFO).

In order to read out a failure record:

- Call up the main menu;
- Call up the sub-menu »Operation/Recorders/Fault rec.«;
- Select a fault record; and
- Analyze the corresponding measured values.

To Read Out the Fault Recorder Via PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Fault Rec« icon within the »Operation/Recorders« tree.
- In the window, the fault recordings are shown in tabular form.
- In order to receive more detailed information on a fault, click the »Plus Sign« in front of the fault number.

NOTICE

Via the print menu, the User can export the data into a file. Please proceed as follows.

•Call up the data as described above.

•Call up the »File/Print« menu.

•Choose »Print Actual Working Window« within the pop-up.

•Press the »Print« button.

•Press the »Export to File« button.

•Enter a file name.

•Choose a location where to save the file.

•Confirm the »Save« button.

Direct Commands of the Fault Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset all rec	Reset all records	Inactive, Active	Inactive	[Operation /Reset]
Man. Trigger	Manual Trigger	False, True	False	[Operation /Recorders /Man. Trigger]

Global Protection Parameters of the Fault Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Prot.Trip	[Device Para /Recorders /Fault rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 8	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Auto overwriting	If there is no more free memory capacity left, the oldest file will be overwritten.	Inactive, Active	Active	[Device Para /Recorders /Fault rec]

Fault Recorder Module Input States

Name	*Description*	*Assignment Via*
Start1-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start2-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start3-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start4-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start5-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start6-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start7-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start8-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]

Fault Recorder Module Signals

Name	*Description*
Reset record	Signal: Delete Record
Man. Trigger	Signal: Manual Trigger

Module: Event Recorder

Event rec

The event recorder can register up to 300 events and the last 50 (minimum) saved events are stored in non-volatile memory, and therefore retailed when power is lost to the unit. The following information is provided for any of the events.

Events are logged as follows:

Record No.	*Fault No.*	*No of grid faults*	*Date of Record*	*Module Name*	*State*
Sequential Number	Number of the ongoing fault. This counter will be incremented by each General Pickup (Prot.Pickup).	A grid fault No. can have several Fault Nos. This counter will be incremented by each General Pickup. (Exception AR: this applies only to devices that offer auto reclosing).	Time stamp	What has changed?	Changed Value

There are three different classes of events.

•***Alternation of binary states are shown as:***
- •0->1 if the signal changes physically from »0« to »1«.
- •1->0 if the signal changes physically from »1« to »0«.

•***Counters increment is shown as:***
- •Old Counter state -> New Counter state (e.g.: 3->4)

•***Alternation of multiple states are shown as:***
- •Old state -> New state (e.g.: 0->2)

Read Out the Event Recorder

- Call up the »*main menu«.*
- Call up the sub-menu *»Operation/Recorders/Event rec«*.
- Select an event.

To Read Out the Event Recorder via PowerPort-E

- If *PowerPort-E* is not running, please start the application.
- If the device data have not been loaded, click »Receive Data From The Device« in the »Device menu.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Event Rec« icon within the »Operation/Recorders« menu.
- In the window, the events are shown in tabular form.

NOTICE

To have the event recorder updated in a cyclic manner, select »Automatic Up-Date« in the »*View*« menu.

PowerPort-E is able to record more events than the device itself, if the window of the event recorder is opened and »Automatic Up-Date« is set to active.

NOTICE **Via the print menu, the User can export the data into a file. Please proceed as follows.**

•Call up the data as described above.

•Call up the »File/Print« menu.

•Choose »Print Actual Working Window« within the pop-up.

•Press the »Print« button.

•Press the »Export to File« button.

•Enter a file name.

•Choose a location where to save the file.

•Confirm the »Save« button.

Direct Commands of the Event Recorder Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset all rec	Reset all records	Inactive, Active	Inactive	[Operation /Reset]

Event Recorder Module Signals

Name	*Description*
Reset all rec	Signal: All records deleted

Module: Modbus® (Modbus)

Modbus

Modbus® Protocol Configuration

The time-controlled Modbus® protocol is based on the master-slave working principle. This means that the substation control and protection system sends an inquiry or instruction to a certain device (slave address) that will then be answered or carried out accordingly. If the inquiry/instruction cannot be answered/carried out (e.g.: because of an invalid slave address), a failure message is returned to the master.

The master (substation control and protection system) can query information from the device, such as:

- Type of unit version;
- Measuring values/statistical measured values;
- Switch operating position (in preparation);
- State of device;
- Time and date;
- State of the device's digital inputs; and
- Protection-/state pickups.

The master (control system) can give commands/instructions to the device, such as:

- Control of switchgear (where applicable, i.e.: each according to the applied device version);
- Change-over of parameter set;
- Reset and acknowledgment of pickups/signals;
- Adjustment of the date and time; and
- Control of pickup relays.

For detailed information on data point lists and error handling, please refer to the Modbus® documentation.

To allow configuration of the devices for Modbus® connection, some default values of the control system must be available.

Device Planning Parameters of the Modbus

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	RTU, TCP	RTU	[Device Planning]

Modbus RTU

Part 1: Configuration of the Devices

Call up *»Device parameter/Modbus«* and set the following communication parameters:

- Slave address, to allow clear identification of the device; and
- Baud rate.

Also, select the RS485 interface-related parameters such as:

- Number of data bits;
- One of the following supported communication variants:
  - Number of data bits,
  - Even,
  - Odd,
  - Parity or no parity, or
  - Number of stop bits;
- *»t-timeout«*: communication errors are only identified after expiration of a supervision time *»t-timeout«*; and
- Response time (defining the period within which an inquiry from the master has to be answered).

Part 2: Hardware Connection

- For hardware connection to the control system, there is an RS485 interface at the rear side of the device (RS485, fiber optic or terminals).
- Connect the bus and the device (wiring).
- Up to 32 devices can be connected to the bus (point to point connection/spurs).
- Connect a terminating resistor to the bus.

Error Handling - Hardware Errors

Information on physical communication errors, such as:

- Baud rate error and
- Parity error;

can be obtained from the event recorder.

Error Handling – Errors on Protocol Level

If, for example, an invalid memory address is inquired, error codes will be returned by the device that need to be interpreted.

Modbus TCP

NOTICE

Establishing a connection via TCP/IP to the device is only possible if the device is equipped with an Ethernet Interface (RJ45).

Contact your IT administrator in order to establish the network connection.

Part 1: Setting the TCP/IP Parameters

Call up *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address;
- Subnetmask; and
- Gateway.

Part 2: Configuration of the Devices

Call up *»Device parameter/Modbus«* and set the following communication parameters.

- Setting a unit identifier is only necessary if a TCP network should be coupled to a RTU network.
- If a different port than the default port 502 should be used, please proceed as follows:
    - Choose “Private” within the TCP-Port-Configuration.
    - Set the port number.
- Set the maximum acceptable time out for “no communication”. If this time has expired without any communication, the device concludes a failure has occurred within the master system.
- Allow or disallow the blocking of SCADA commands.

Part 3: Hardware Connection

- There is a RJ45 interface at the rear side of the device for the hardware connection to the control system.
- Establish the connection to the device by means of a proper Ethernet cable.

Direct Commands of the Modbus®

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset Diagn Cr	All Modbus Diagnosis Counters will be reset.	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Modbus®

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Slave ID	Device address (Slave ID) within the bus system. Each device address has to be unique within a bus system. Only available if:Device Planning = RTU	1 - 247	1	[Device Para /Modbus]
Unit ID	The Unit Identifier is used for routing. This parameter is to be set, if a Modbus RTU and a Modbus TCP network should be coupled. Only available if:Device Planning = TCP	1 - 255	255	[Device Para /Modbus]
TCP Port Config	TCP Port Configuration. This parameter is to be set only if the default Modubs TCP Port should not be used. Only available if:Device Planning = TCP	Default, Private	Default	[Device Para /Modbus]
Port	Port number Only available if:Device Planning = TCP And Only available if: TCP Port Config = Private	502 - 65535	502	[Device Para /Modbus]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-timeout	Within this time the answer has to be received by the Communication system, otherwise the request will be disregarded. In that case, the Communication system detects a communication failure and the Communication System has to send a new request. Only available if:Device Planning = RTU	0.01 - 10.00s	1s	[Device Para /Modbus]
Baud rate	Baud rate Only available if:Device Planning = RTU	1200, 2400, 4800, 9600, 19200, 38400	19200	[Device Para /Modbus]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Physical Settings	Digit 1: Number of bits. Digit 2: E=even parity, O=odd parity, N=no parity. Digit 3: Number of stop bits. More information on the parity: It is possible that the last data bit is followed by a parity bit which is used for recognition of communication errors. The parity bit ensures that with even parity ("EVEN") always an even number of bits with valence "1" or with odd parity ("ODD") an odd number of "1" valence bits are transmitted. But it is also possible to transmit no parity bits (here the setting is "Parity = None"). More information on the stop-bits: The end of a data byte is terminated by the stop-bits. Only available if:Device Planning = RTU	8E1, 8O1, 8N1, 8N2	8E1	[Device Para /Modbus]
t-call	If there is no request message sent from Communication to the device after expiry of this time, the device concludes a communication failure within the Communication system.	1 - 3600s	10s	[Device Para /Modbus]
Comm CmdBlo	Activating (allowing)/ Deactivating (disallowing) the blocking of the Communication Commands	Inactive, Active	Inactive	[Device Para /Modbus]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Disable Latching	Disable Latching: If this parameter is active (true), none of the Modbus states will be latched. That means that trip signals wont be latched by Modbus.	Inactive, Active	Inactive	[Device Para /Modbus]

Modbus® Module Signals (Output States)

NOTICE **Some signals (that are active for a short time only) have to be acknowledged separately (e.g.: trip signals) by the communication system.**

Name	*Description*
Transmission	Signal: Communication Active
Comm Cmd 1	Communication Command
Comm Cmd 2	Communication Command
Comm Cmd 3	Communication Command
Comm Cmd 4	Communication Command
Comm Cmd 5	Communication Command
Comm Cmd 6	Communication Command
Comm Cmd 7	Communication Command
Comm Cmd 8	Communication Command
Comm Cmd 9	Communication Command
Comm Cmd 10	Communication Command
Comm Cmd 11	Communication Command
Comm Cmd 12	Communication Command
Comm Cmd 13	Communication Command
Comm Cmd 14	Communication Command
Comm Cmd 15	Communication Command
Comm Cmd 16	Communication Command

Modbus® Module Values

Value	*Description*	*Default*	*Size*	*Menu Path*
NoOfRequestsTotal	Total number of requests. Includes requests for other slaves.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfRequestsForMe	Total Number of requests for this slave.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfResponse	Total number of requests having been responded.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfResponsTimeOverruns	Total number of requests with exceeded response time. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfOverrunErros	Total Number of Overrun Failures. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfParityErrors	Total number of parity errors. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfFrameErrors	Total Number of Frame Errors. Physically corrupted Frame.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfBreaks	Number of detected communication aborts	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfQueryInvalid	Total Number of Request errors. Request could not be interpreted	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfInternalError	Total Number of Internal errors while interpreting the request.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]

Parameters

Parameter setting and planning can be done:

•Directly at the device; or

•By way of the *PowerPort-E* software application.

Parameter Definitions

Device Parameters

Device Parameters are part of the Device Parameter tree. By modifying the Device Parameters, the User may (depending on the type of device):

- Set cutoff levels;
- Assign digital inputs, Assign LEDs;
- Assign acknowledgment signals;
- Configure statistics;
- Adapt HMI settings;
- Configure recorders (reports);
- Set date and time;
- Change passwords; and/or
- Check the version (build) of the device.

System Parameters

System Parameters are part of the Device Parameter tree. System Parameters comprise the essential, basic settings of your switchboard such as rated frequency and transformer ratios.

Protection Parameters

Protection Parameters are part of the Device Parameter tree. This Protection Parameters include the following.

- ***Global Protection Parameters are part of the Protection Parameters:*** All settings and assignments that are done within the Global Parameter tree are valid independent of the Setting Groups. They have to be set only once. In addition, Global Protection Parameters include the parameters used for Breaker Management.

- ***The Parameter Setting Switch is part of the Protection Parameters:*** The User may either directly switch to a certain parameter setting group or determine the conditions for switching to another parameter setting group.

- ***Setting Group Parameters are part of the Protection Parameters:*** By means of the Setting Group Parameters, the User may individually adapt the protective device to the current conditions or grid conditions. The Setting Group Parameters may be individually set in each Settings group.

Device Planning Parameters

Device Planning Parameters are part of the Device Parameter tree.

- ***Improving the Usability (Clarity):*** All protection modules that are currently unused can be hidden (switched to invisible) through Device Planning. In the Device Planning menu, the User can adapt the scope of functionality of the protective device exactly as needed. The User can improve the usability by hiding all modules that are not currently needed.

- ***Adapting the device to the application:*** For those modules that are needed, determine how they should be set up (e.g.: directional, non-directional, <, >...).

Direct Commands

Direct Commands are part of the Device Parameter tree but ***NOT*** part of the parameter file. They will be executed directly (e.g.: Resetting of a Counter).

State of the Module Inputs

Module Inputs are part of the Device Parameter tree. The State of the Module Input is context-dependent.

By means of the Module Inputs, information can be passed to and acted upon by the modules. The User can assign signals to ***Module Inputs***. The state of the signals that are assigned to an input can be viewed from the Status Display. Module Inputs can be identified by an ***"-I"*** at the end of the name.

Signals

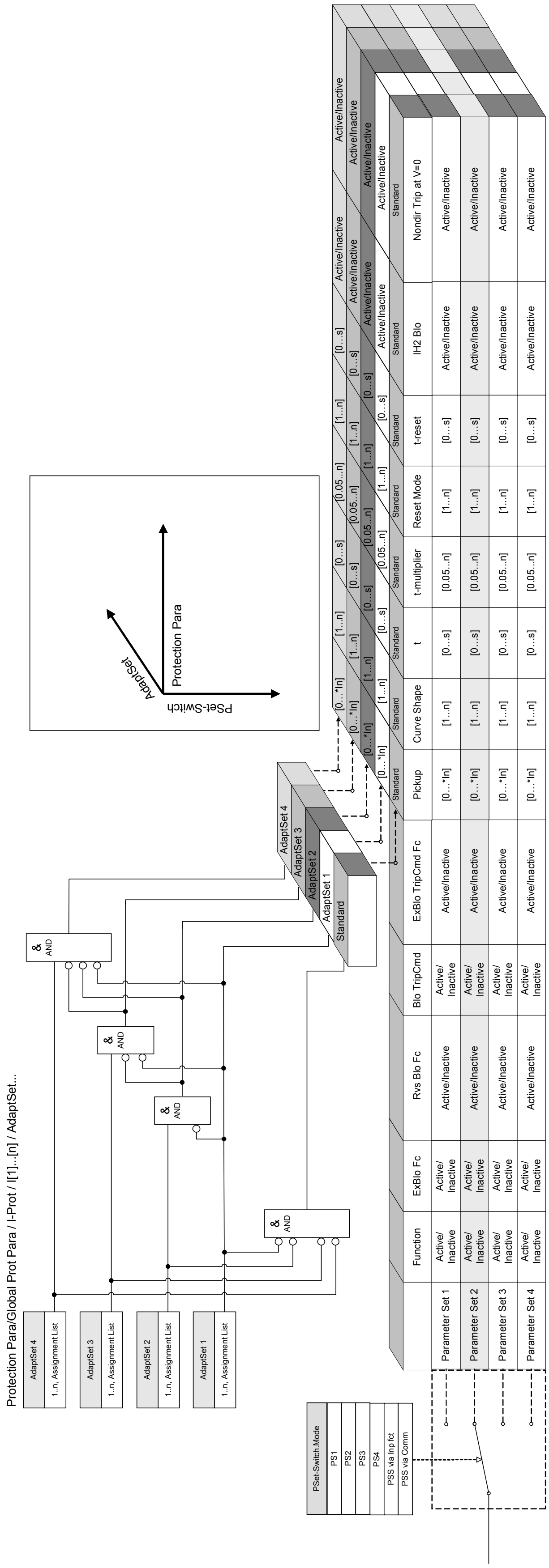
Signals are part of the Device Parameter tree. The state of the signal is context-dependent.

- ***Signals*** represent the state of the installation/equipment (e.g.: position indicators of the breaker).

- ***Signals*** are assessments of the state of the grid and the equipment (System OK, Transformer failure detected, ...).

- ***Signals*** represent decisions that are taken by the device (e.g.: Trip Command) based on the User parameter settings.

Adaptive Parameter Sets



Adaptive Parameter Sets are part of the Device Parameter tree.

By means of ***Adaptive Parameter Sets***, the User can temporarily modify single parameters within the Parameter Setting groups.

NOTICE **Adaptive Parameters drop-out automatically if the acknowledged signal that has activated them has dropped-out. Please take into account that Adaptive Set 1 is dominant to Adaptive Set 2. Adaptive Set 2 is dominant to Adaptive Set 3. Adaptive Set 3 is dominant to Adaptive Set 4.**

NOTICE **In order to increase the usability (clarity), Adaptive Parameter Sets become visible if a corresponding activation signal has been assigned (PowerPort-E V. 1.2 and higher).**

Example: In order to use Adaptive Parameters within Protective Element I [1], please proceed as follows.

- **Assign within the Global Parameter tree, within Protective Element I[1], an activation signal for Adaptive Parameter Set 1.**
- **Adaptive Parameter Set 1 becomes now visible within the Protection Parameter Sets for element I[1].**

By means of additional activation signals, further Adaptive Parameter Sets can be used.

The functionality of the IED (relay) can be enhanced / adapted, by means of ***Adaptive Parameters*** in order to meet the requirements of modified states of the grid or the power supply system respectively, to manage unpredictable events.

Moreover, the adaptive parameter can also be used to realize various special protective functions or to expand the existing function modules in a simple way, without costly redesign the existing hardware or software platform.

The ***Adaptive Parameter*** feature allows, besides a standard parameter set, one of the four parameter sets labeled from 1 to 4, to be used, for example, in a time overcurrent element under the control of the configurable Set Control Logics. The dynamic switch-over of the adaptive parameter set is only active for a particular element when its adaptive set control logic is configured and only as long as the activation signal is true.

For some protection elements, such as time overcurrent and instantaneous overcurrent (50P, 51P, 50G, 51G, …), besides the “default” setting there exists another four “alternative” settings for pickup value, curve type, time dial, and reset mode set values that can dynamically be switched-over by means of the configurable adaptive setting control logics in the single set parameter.

If the ***Adaptive Parameter*** feature is not used, the adaptive set control logics will not be selected (assigned). The protective elements work, in this case, just like a normal protection using the “Default” settings. If one of the ***Adaptive Set*** Control logics is assigned to a logic function, the protective element will be “switched-over” to the corresponding adaptive settings if the assigned logic function is asserted and will drop-out to the “Default” setting if the assigned signal that has activated the ***Adaptive Set*** has dropped-out.

Adaptive Parameters via HMI

NOTICE **The use of Adaptive Parameters via the HMI (panel) differs a bit to the use via PowerPort-E.**

Adaptive Parameters can be also used via the HMI (instead of using the recommended *PowerPort-E*). The principle method of using them via the HMI is as follows.

1. Assign an activation signal for an Adaptive Parameter Set within the Global Parameters »*Global Para*« for a protective element (available for current functions only).
2. Call up this protective element within a Setting Group.
3. Go to the parameter that should be modified adaptively and call it up for editing (arrow-right-key).
4. Choose the corresponding Adaptive Set.
5. Set the modified parameter for the selected Adaptive Set.

Application Example

The tripping time »*t*« for the *50[1]* element of »*Parameter Set 1*« should be desensitized (reduced) in case Digital Input 2 becomes active.

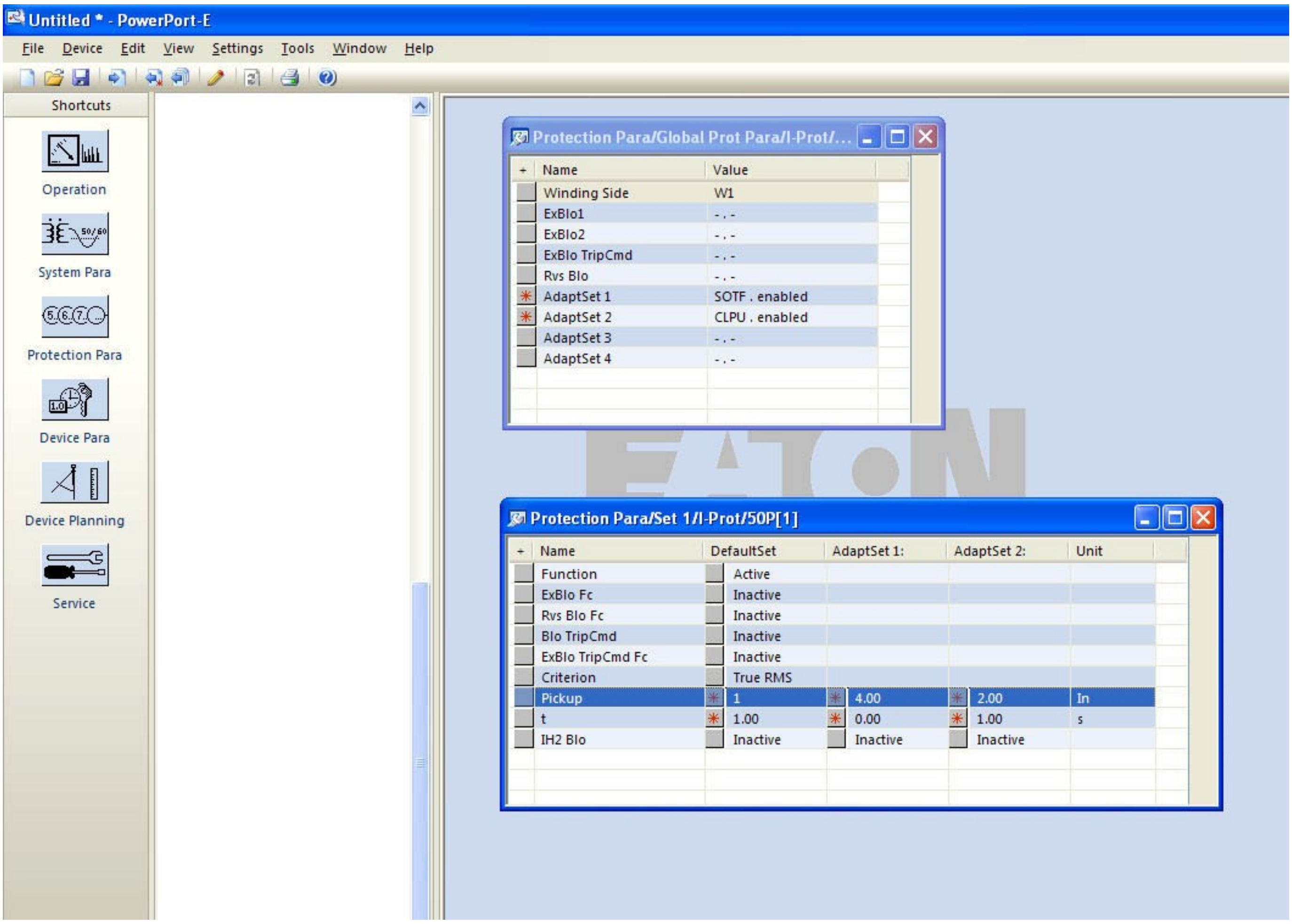
1. Call up the menu [Protection Para/Global Protection Para/I-Prot/50[1]/Adaptive Para1] and assign Digital Input 2 as activation signal.
2. Call up the *50[1]* element within the menu [Protection Para/Set[1]/I-Port/50[1].
3. Go to the tripping time parameter »*t*« by means of the softkey (arrow-down) and call up the submenu by means of the softkey (arrow-right).
4. Call up the corresponding parameter set (Adaptive Set 1 in this example).
5. Set the reduced tripping time for »*Adaptive Set 1*«.

Check and confirm that the functionality is in compliance with your protection plan via a commissioning test.

Application Example

During a “Switch-OnTo-Fault” condition, the User is usually requested to make the embedded protective function tripping of the faulted line faster, instantaneous, or sometimes non-directional.

Such a “Switch-OnTo-Fault” application can easily be realized using the ***Adaptive Parameter*** features mentioned previously. The standard time overcurrent protection element (e.g.: 51P) should trip instantaneously in case of *SOTF* condition,. If the *SOTF* logic function »SOTF ENABLED« is detecting a manual breaker close condition, the relay switches to ***Adaptive Set 1*** if the signal »SOTF.ENABLED« is assigned to ***Adaptive Set 1***. The corresponding ***Adaptive Set 1*** will become active and than »*t = 0*« sec.



The screen shot above shows the adaptive setting configurations following applications based on only one simple overcurrent protection element:

1. Standard Set: Default settings;
2. Adaptive Set 1: SOTF application (Switch-OnTo-Fault);
3. Adaptive Set 2: CLPU application (Cold Load Pickup);

Application Examples

- The output signal of the Switch OnTo Fault module can be used to activate an ***Adaptive Parameter Set*** that sensitizes the overcurrent protection.
- The output signal of the Cold Load Pickup module can be used to activate an ***Adaptive Parameter Set*** that desensitizes the overcurrent protection.
- By means of ***Adaptive Parameter Sets,*** an Adaptive Auto Reclosure can be realized. After a reclosure attempt, the tripping thresholds or tripping curves of the overcurrent protection can be adapted.
- Depending on undervoltage, the overcurrent protection can be modified (voltage controlled). This applies to devices that offer voltage protection only.
- The ground overcurrent protection can be modified by the residual voltage. This applies to devices that offer voltage protection only.
- Dynamic and automatic adaption of the ground current settings in order to adapt the settings to different loads (single-phase load diversity).

NOTICE

Adaptive Parameter Sets are only available for devices with current protection modules.

Adaptive Parameter Set Activation Signals

Name	*Description*
-.-	No assignment
27M[1].Pickup	Signal: Pickup Voltage Element
27M[2].Pickup	Signal: Pickup Voltage Element
59M[1].Pickup	Signal: Pickup Voltage Element
59M[2].Pickup	Signal: Pickup Voltage Element
47[1].Pickup	Signal: Pickup Voltage Asymmetry
47[2].Pickup	Signal: Pickup Voltage Asymmetry
SOTF.enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
CLPU.enabled	Signal: Cold Load enabled
DI-8P X1.DI 1	Signal: Digital Input
DI-8P X1.DI 2	Signal: Digital Input
DI-8P X1.DI 3	Signal: Digital Input
DI-8P X1.DI 4	Signal: Digital Input
DI-8P X1.DI 5	Signal: Digital Input
DI-8P X1.DI 6	Signal: Digital Input
DI-8P X1.DI 7	Signal: Digital Input
DI-8P X1.DI 8	Signal: Digital Input
Sys.Maint Mode Active	Signal: Arc Flash Reduction Maintenance Active
Sys.Maint Mode Inactive	Signal: Arc Flash Reduction Maintenance Inactive

Operational Modes (Access Authorization)

Operational Mode – »Display Only«

•The protection is activated.

•All data, measuring values, records, and counters/meters can be viewed.

Operation Mode – »Parameter Setting and Planning«

In this mode, the User is able to:

•Edit and set parameters;

•Change device planning details; and

•Configure and reset operational data (event recorder/fault recorder/power meter/switching cycles).

NOTICE **If the device was not active within the parameter setting mode for a longer time (can be set between 20 – 3600 seconds), the device will automatically reset to »Display Only« mode (Please refer to the Appendix *Module Panel*).**

NOTICE **As long as the User is within the parameter setting mode, the device cannot acknowledge.**

In order to change into the operation mode (»Parameter Setting«) please proceed as follows.

1. Mark the parameter to be changed in the device display.
2. Press the »Wrench« soft key to temporarily change into the Parameter Setting mode.
3. Enter the parameter password.
4. Change the parameter.
5. Change any additional parameters that are needed.

NOTICE **As long as the User is within the parameter setting mode, a wrench icon will be shown in the upper right corner of the display.**

6. For saving the altered parameter(s):

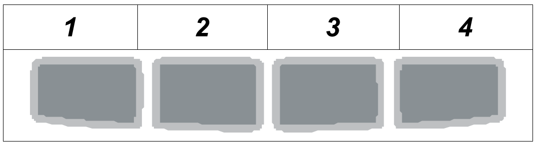
•Press the »OK« key; and
•Confirm by pressing the »Yes« soft key.

7. Then the device changes into the »Display Only« mode.

Password

Password Entry at the Panel

Passwords can be entered by way of the soft keys



Example: For password (3244) press successively:

•Soft key 3;
•Soft key 2;
•Soft key 4; and
•Soft key 4.

Password Changes

Passwords can be changed at the device in the »Device Para/Password« menu or by means of the *PowerPort-E* software.

NOTICE **A password must be a User-defined combination of the numbers 1, 2, 3, and 4.**

All other characters and keys WILL NOT be accepted.

The password for the operation mode »Parameter setting and planning« enables the User to transfer parameters from the *PowerPort-E* software into the device.

When the User wants to change a password, the existing one has to be entered first. The new password (up to 8 digits) is then to be confirmed twice. Please proceed as follows.

•In order to change the password, please enter the old password followed by pressing the »OK« key.

•Next, enter the new password and press the »OK« key.

•Finally, confirm your new password and press the »OK« key.

Password Forgotten

All passwords can be reset to the fail-safe adjustment (1234) by pressing the »Ack/Rst« key during cold booting. For this procedure, confirm the inquiry »Reset Passwords?« with »Yes«.

Changing of Parameters - Example

•Move to the parameter to be change by using the soft keys.

•Press the »Wrench« soft key.

•Enter the password for parameter setting.

•Edit/change the parameter.

Now the User can:

•Save the change made and have it adopted by the system; or

•Change additional parameters and save all the altered parameters and have them adopted by the system.

To Save Parameter Changes Immediately

•Press the »OK« key to save the changed parameters directly and to have them adopted by the device. Confirm the parameter changes by pressing the »Yes« soft key or dismiss by pressing »No« soft key.

To Change Additional Parameters and Save Afterwards

•Move to other parameters and change them.

NOTICE

A star symbol in front of the changed parameters indicates that the modifications have only temporarily been saved. They are not yet stored and adopted by the device.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher-ranking menu level, the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow from the main menu level at any time where parameter changes have been made and have not been saved.

In addition to the star trace to the temporarily saved parameter changes, a general parameter changing symbol is faded in at the left corner of the display. It is possible from each point of the menu tree to see that there are parameter changes still not adopted by the device.

Press the »OK« key to initiate the final storage of all parameter changes. Confirm the parameter changes by pressing the »Yes« soft key or dismiss by pressing the »No« soft key.

NOTICE

Plausibility Check

In order to prevent obvious incorrect settings, the device constantly monitors all temporarily saved parameter changes. If the device detects a conflict, it is indicated by a question mark in front of the respective parameter.

In order to make things easier to follow, especially where complex parameter changes are involved, a question mark appears above the temporarily saved parameters (on every superior/higher- ranking menu level). This makes it possible to control or follow, from the main menu level, where conflicts are intended to be saved. This can be done at any time.

In addition to the question mark trace to the temporarily saved conflict parameter changes, a general conflict symbol/question mark is faded-in at the left corner of the display, and so it is possible to see from each point of the menu tree that conflicts have been detected by the device.

A star/parameter change indication is always overwritten by the question mark/conflict symbol.

If a device detects a conflict, it rejects saving and adopting of the parameters.

Example: If the residual voltage has been configured as »calculated« (*»EVTcon = calculated«*), then the device recognizes a conflict in case voltage measuring is configured as »Phase to Phase« (*»VTcon = Phase to Phase«*). The calculation of the residual voltage is physically not possible by means of phase-to-phase voltages.

Changing of Parameters When Using the PowerPort-E - Example

Example: Changing of a protective parameter (to alter the characteristic for the overcurrent protection function I[1] in Parameter Set 1).

•If *PowerPort-E* is not in operation, please start the application.

•If the device data have not been loaded, select »Data To Be Received From The Device« in the »Device« menu.

•Double-click the »Protection Para Icon« in the navigation tree.

•Double-click the »Protection Para Set Icon« in the navigation tree.

•Double-click the »Set 1 Icon« in the navigation tree.

•Double-click the »protection stage I[1]« in the navigation tree.

•In the working window, a tabulated overview appears showing the parameters assigned to this protective function.

•In this table, double-click the value/parameter to be changed (in this example: *»Char«*).

•Another window (pop-up) is opened where the User can select the required characteristic.

•Close this window by clicking the »OK« key.

NOTICE

A star symbol in front of the changed parameters indicates that the alterations have only temporarily been saved. They are not yet stored and adopted by the software/device.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level, the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow, from the main menu level, where parameter changes have been made and have not been saved. This can be done at any time.

NOTICE

Plausibility Check

In order to prevent obvious incorrect settings, the application constantly monitors all temporarily saved parameter changes. If the device detects a conflict, it is indicated by a question mark in front of the respective parameter.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level above of the temporarily saved parameters, a conflict is indicated by a question mark (plausibility trace). This makes it possible to control or follow, from the main menu level, where conflicts exist. This can be done at any time.

So it is possible to see from each point of the menu tree that conflicts have been detected by the application.

A star/parameter change indication is always overwritten by the question mark/conflict symbol.

If the software detects a conflict, it rejects the saving and adopting of the parameters.

Example: If the residual voltage has been configured as *»Calculated«* (*»EVTcon = calculated«*), then the application recognizes a conflict in case voltage measuring is configured as »Phase to Phase« (*»VTcon = Phase to Phase«*). The calculation of the residual voltage is physically not possible by means of phase-to-phase voltages.

•Additional parameters can be changed if required.

•In order to transfer changed parameters into the device, please select »Transfer all parameters into the device« in the »Device« menu.

•Confirm the safety inquiry »Shall The Parameters Be Overwritten?«.

•Enter the password for setting parameters in the pop-up window.

•Confirm the inquiry »Shall The Data Be Saved Locally?« with »Yes« (recommended). Select a suitable storing location on your hard disk.

•Confirm the selected storage location by clicking »Save«.

•The changed parameter data is now saved in the data file chosen. Thereafter, the changed data is transferred to the device and adopted.

•

NOTICE

Once the User has entered the parameter setting password, PowerPort-E will not ask the User again for the password for at least 10 minutes. This time interval will start again each time parameters are transmitted into the device. If, for more than 10 minutes, no parameters are transmitted into the device, PowerPort-E will again ask for the password when the User tries to transmit parameters into the device.

Protection Parameters

WARNING **Please note that by deactivating, for example protective functions, the User also changes the functionality of the device.**

The manufacturer does not accept liability for any personal or material damage as a result of incorrect planning.

Contact your Eaton Customer Service representative for more information.

The protection parameters include the following protection parameter trees.

•Global Protection Parameters *»Global Prot Para«*: Here the User can find all protection parameters that are universally valid. That means they are valid independent of the protection parameter sets.

•Setting Group Parameters *»Set1..4«*: The protection parameters that the User set within a parameter set are only valid if the parameter set selected is switched to active.

Setting Groups

Setting Group Switch

Within the »Protection Para/P-Set Switch« menu, the User has the following possibilities:

•To manually set one of the four setting groups active;

•To assign a signal to each setting group that sets this group to active; and

•Scada switches the setting groups.

Setting Group Switch			
	Manual Selection	*Via Input Function (e.g.: Digital Input)*	*Via Scada*
Switching Options	Switch over, if another setting group is chosen manually within the »Protection Para/P-Set Switch« menu.	Switch over not until the request is clear. That means if there is more or less than one request signal active, no switch over will be executed.	Switch over if there is a clear Scada request. Otherwise no switch over will be executed.

NOTICE **The description of the parameters can be found within the “System Parameters” section.**

Setting Group Switch Via PowerPort-E

•If *PowerPort-E* is not running, please start the application.

•If the device data have not been loaded, click »Receive Data From The Device« in the »Device« menu.

•Double click the »Protection Para« icon in the navigation tree.

•Double click the »P-Set Switch« within the protection parameters.

•To configure the Setting Group Switch respectively, manually choose an active set.

NOTICE **The description of the parameters can be found within the "System Parameters" section.**

Copying Setting Groups (Parameter Sets) Via PowerPort-E

NOTICE **Setting groups can only be copied if there are no conflicts (no red question marks).**

For applications using multiple settings groups, one can use the configuration file from the first group to create the second group. With the help of PowerPort-E, the User can simply copy an existing setting group to another (not yet configured) one. The User only needs to change those parameters where the two setting groups are different.

To efficiently establish a second parameter set where only few parameters are different, proceed as follows.

•If *PowerPort-E* is not running, please start the application.

•Open a (off-line) parameter file of a device or load data of a connected device.

•Carefully save the relevant device parameters by selecting [File\Save as].

•Select »Copy Parameter Sets« out of the “Edit” menu.

•Then define both source and destination of the parameter sets to be copied (source = copy from; destination: copy to).

•Click on »OK« to start the copy procedure.

•The copied parameter set is now cached (not yet saved!).

•Then, modify the copied parameter set(s), if applicable.

•Assign a new file name to the revised device parameter file and save it on your hard disk (backup copy).

•To transfer the modified parameters back to the device, click on the »Device« menu item and select »Transfer All Parameters into the Device«.

Comparing Setting Groups Via PowerPort-E

•If *PowerPort-E* is not running, please start the application.

•Click on menu item »Edit« and select »Compare Parameter Sets«.

•Select the two parameter sets from the two drop down menus that are to be compared with each other.

•Press the »Compare« button.

•The values that are different from the set parameters will be listed in tabular form.

Comparing Parameter Files Via PowerPort-E

With the help of PowerPort-E, the User can simply compare/differentiate the currently open parameter/device file against a file on the hard disk. The precondition is that the versions and type of devices match. To compare the parameter files, please proceed as follows.

•Click on »Compare with a Parameter File« within the »Device« menu.

•Click on the Folder icon in order to select a file on your hard disk.

•The differences will be shown in tabular form.

Converting Parameter Files Via PowerPort-E

Parameter files of the same type can be up- or down-graded (converted). During this process, the new parameter file will keep all active settings from the source parameter file and, at the same time, remove all inactive settings. As many parameters as possible will be converted.

•Parameters that are newly added will be set to default.

•Parameters that are not included in the target file version will be deleted.

In order to convert a parameter file please proceed as follows.

•If *PowerPort-E* is not in operation, please start the application.

•Open a parameter file or load the parameters from a device that should be converted.

•Make a backup of this file in a fail-safe place.

•Choose »Save as« from the »File« menu.

•Enter a new file name (in order to prevent overwriting the original file).

•Choose the new file type from drop down menu »File Type«.

•Confirm the security check by clicking on »Yes« only if the User is sure that the file conversion should be executed.

•In tabular form the modifications will be shown as follows.

Added parameter:	
Deleted parameter:	

System Parameters

System Para

Within the system parameters, the User can set all parameters that are relevant for the primary side and the mains operational method like frequency, primary and secondary values, and the star point treatment.

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Phase Sequence	Phase Sequence direction	ABC, ACB	ABC	[System Para]
f	Nominal frequency	50Hz, 60Hz	60Hz	[System Para]
Main VT pri	Primary Voltage of Main VTs. The phase to phase voltage is to be entered even if the load is in delta connection.	60 - 500000V	12000V	[System Para]
Main VT sec	Secondary Voltage of Main VTs. The phase to phase voltage is to be entered even if the load is in delta connection.	60.00 - 400.00V	120V	[System Para]
Main VT con	Main VTs connection	Wye, Open-Delta	Wye	[System Para]
Aux VT pri	Primary voltage of Aux VTs	60 - 500000V	12000V	[System Para]
Aux VT sec	Secondary voltage of Aux VTs	35.00 - 400.00V	120V	[System Para]
CT con	Current transformer connection	3-wire, 4th CT IN, 4th CT IG	3-wire	[System Para]

CT pri	Nominal current of the primary side of the current transformers.	1 - 50000A	500A	[System Para]
CT sec	Nominal current of the secondary side of the current transformers.	1A, 5A	5A	[System Para]
CT dir	Protection functions with directional feature can only work properly if the connection of the current transformers is free of wiring errors. If all current transformers are connected to the device with a wrong polarity, the wiring error can be compensated by this parameter. This parameter turns the current vectors by 180 degrees.	0°, 180°	0°	[System Para]
XCT pri	This parameter defines the primary nominal current of the connected ground current transformer. If the ground current is measured via the Residual connection, the primary value of the phase current transformer must be entered here.	1 - 50000A	50A	[System Para]

XCT sec	This parameter defines the secondary nominal current of the connected ground current transformer. If the ground current is done via the Residual connection, the primary value of the phase current transformer must be entered here.	1A, 5A	5A	[System Para]
XCT dir	Ground fault protection with directional feature depends also on the correct wiring of the ground current transformer. A wrong polarity/wiring can be corrected by means of the settings "0°" or "180°". The operator has the possibility of turning the current vector by "180°" (change of sign) without modification of the wiring. This means, that – in terms of figures - the determined current indicator was turned by "180°" by the device.	0°, 180°	0°	[System Para]

Blocking

The device provides a function for temporary blocking of the complete protection functionality or of single protections.

WARNING **Make absolutely sure that no illogical or even life-threatening blockings are allocated.**

Make sure not to carelessly deactivate protection functions that have to be available according to the protection concept.

Permanent Blocking

Switching "On" or "Off" the Complete Protection Functionality

In the *»Protection«* module, the complete protection of the device can be switched "On" or "Off". Set the Function parameter to *»Active«* or *»Inactive«* in the *»Prot«* module.

WARNING **Protection is activated only if in the »Prot« module the parameter *Function* is = *»Active«* (i.e.: with *»Function«* = *»Inactive«,* no protection function are operating). If *»Function«* = *»Inactive«,* then the device cannot protect any components.**

Switching Modules "On" or "Off"

Each of the modules can be switched "On" or "Off" (permanently). This is achieved when the »*Function«* parameter is set to »Active« or »Inactive« in the respective module.

Activating or Deactivating the Tripping Command of a Protection Permanently

In each of the protections, the tripping command to the breaker can be permanently blocked. For this purpose, the *»TripCmd Blo«* parameter has to be set to *»Active«*.

Temporary Blocking

To Block the Complete Protection of the Device Temporarily by a Signal

In the *»Prot«* module, the complete protection of the device can be blocked temporarily by a signal. On the condition that a module-external blocking is permitted (*»ExBlo Fc=active«)*. In addition to this, a related blocking signal from the »Assignment list« must have been assigned. For the time the allocated blocking signal is active, the module is blocked.

WARNING **If the *»Prot«* module is blocked, the complete protection function does not work. As long as the blocking signal is active, the device cannot protect any components.**

To Block a Complete Protection Module Temporarily by an Active Assignment

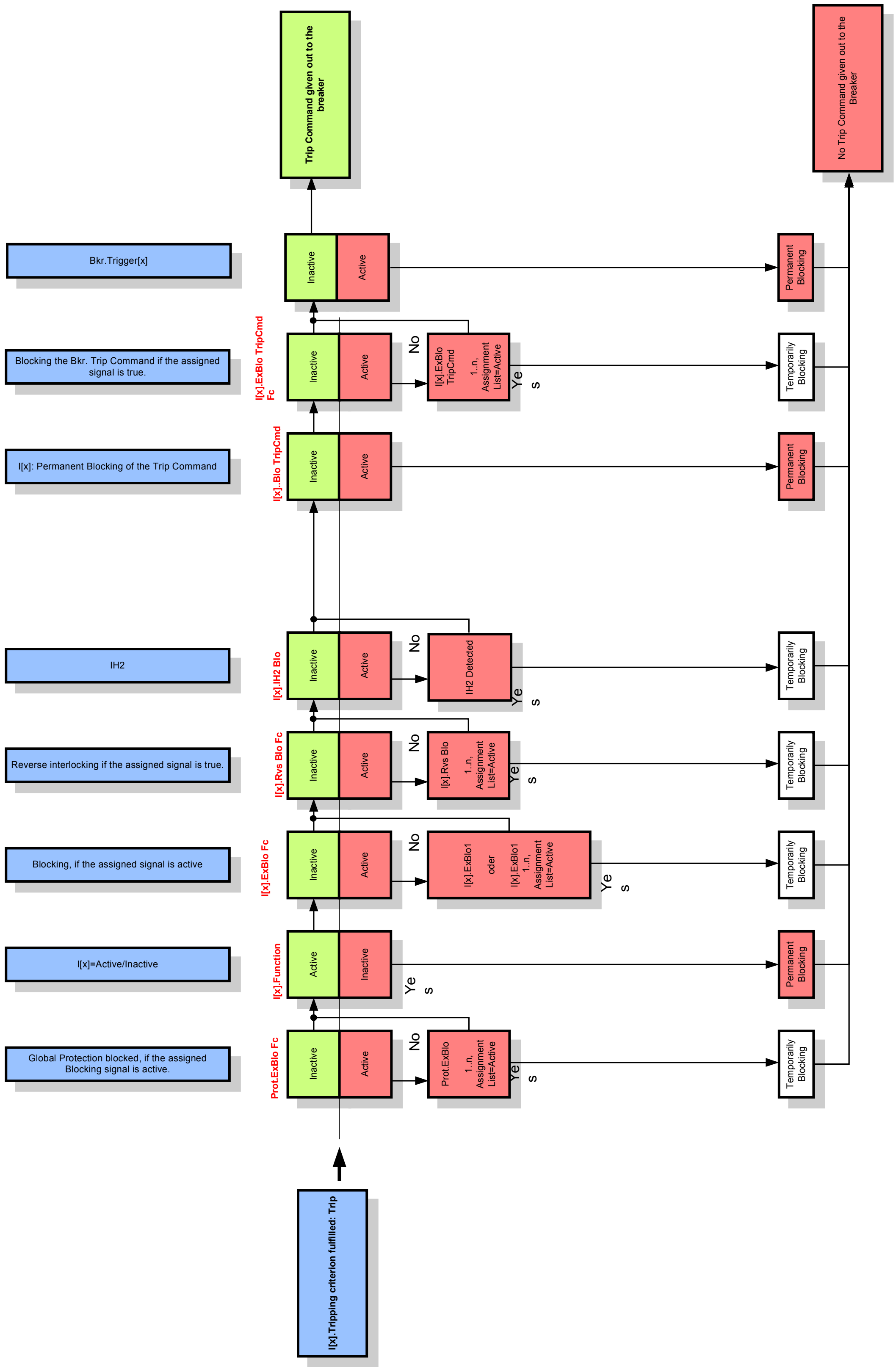
- In order to establish a temporary blockage of a protection module, the parameter *»ExBlo Fc«* of the module has to be set to *»Active«*. This gives the permission: »This module can be blocked«.
- Within the general protection parameters, a signal has to be additionally chosen from the »Assignment

list«. The blocking only becomes active when the assigned signal is active.

To Block the Tripping Command of a Protection Element Temporarily by an Active Assignment

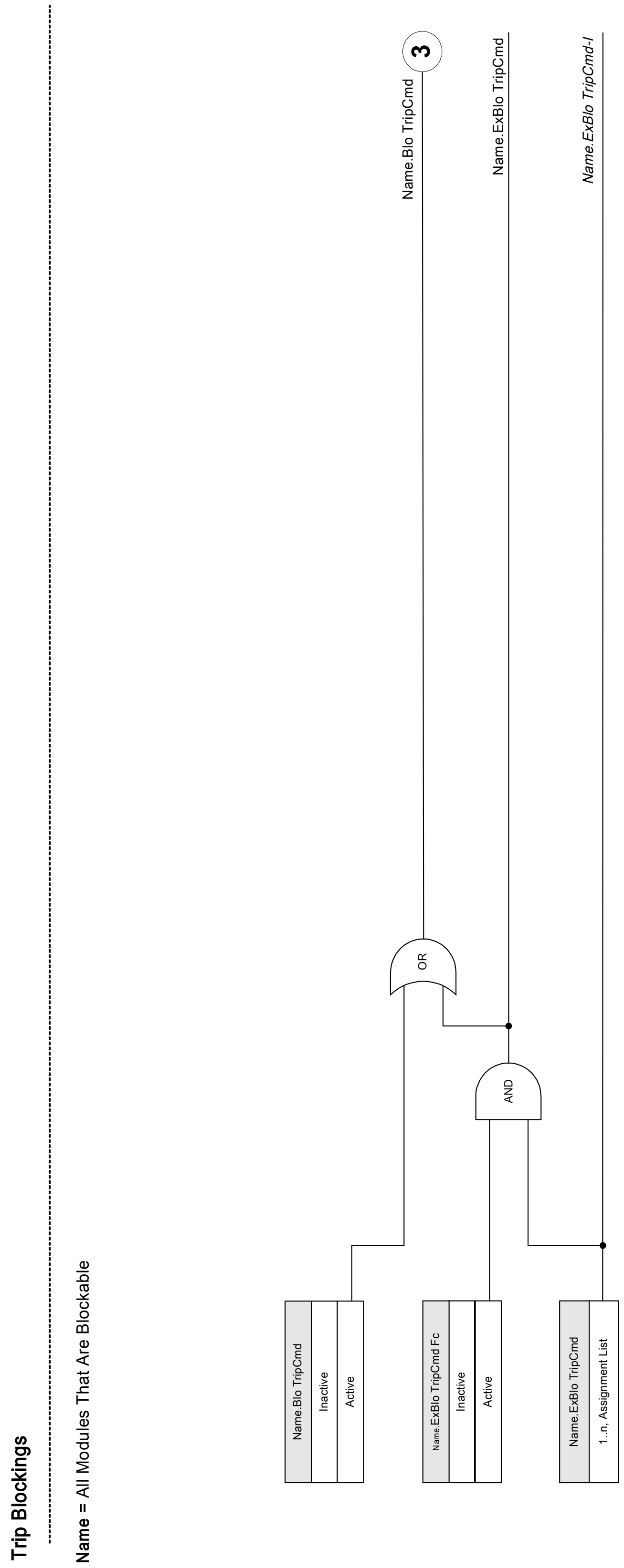
The tripping command of any of the protection modules can be blocked from an external signal. In this case, external does not only mean from outside the device, but also from outside the module. Not only real external signals are permitted to be used as blocking signals (for example: the state of a digital input), but the User can also choose any other signal from the »Assignment list«.

- In order to establish a temporary blockage of a protection element, the parameter *»ExBlo TripCmd Fc«* of the module has to be set to *»Active«*. This gives the permission: »The tripping command of this element can be blocked«.
- Within the general protection parameters, an additional signal has to be chosen and assigned to the *»ExBlo«* parameter from the »Assignment list«. If the selected signal is activated, the temporary blockage becomes effective.

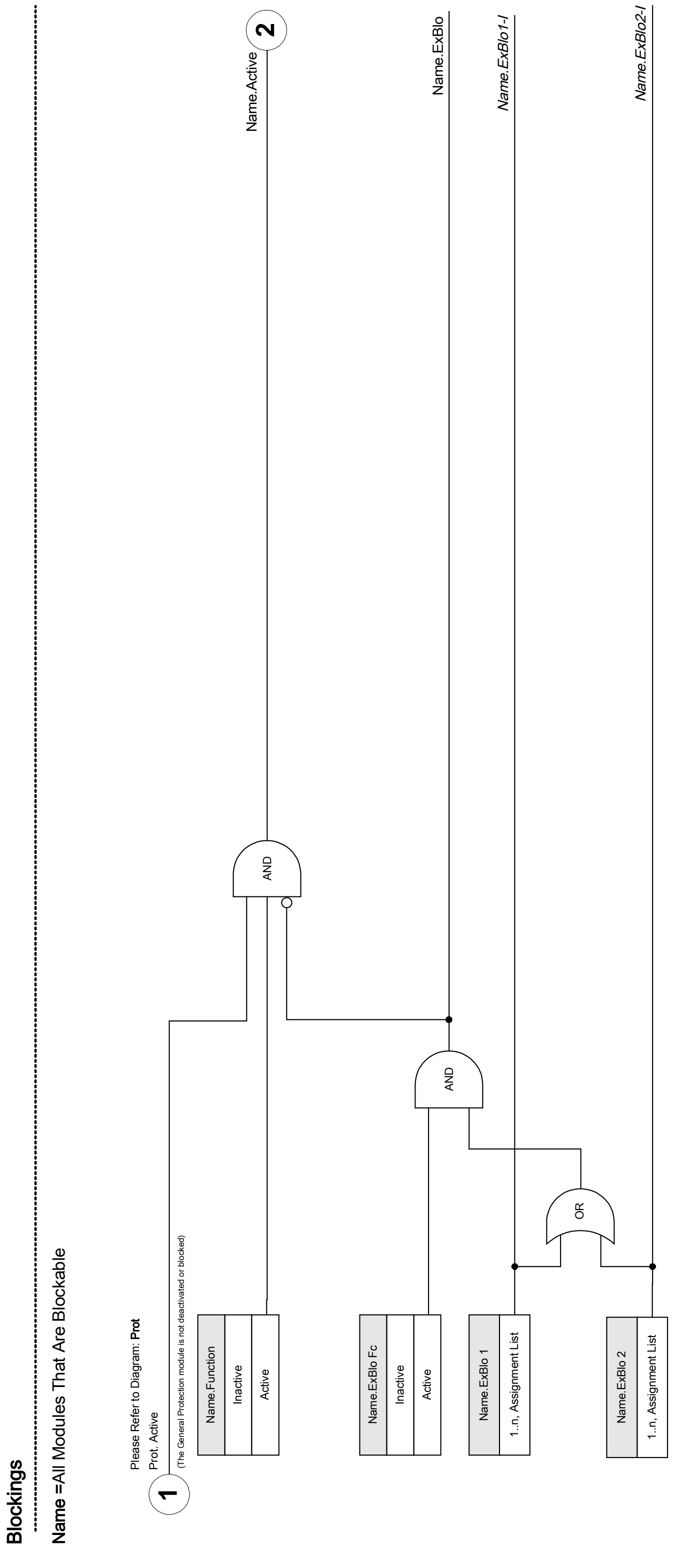


Tripping criterion fulfilled for I (overcurrent protection module: e.g. 50P[x]). How could the trip command be blocked?

To Activate or Deactivate the Tripping Command of a Protection Module

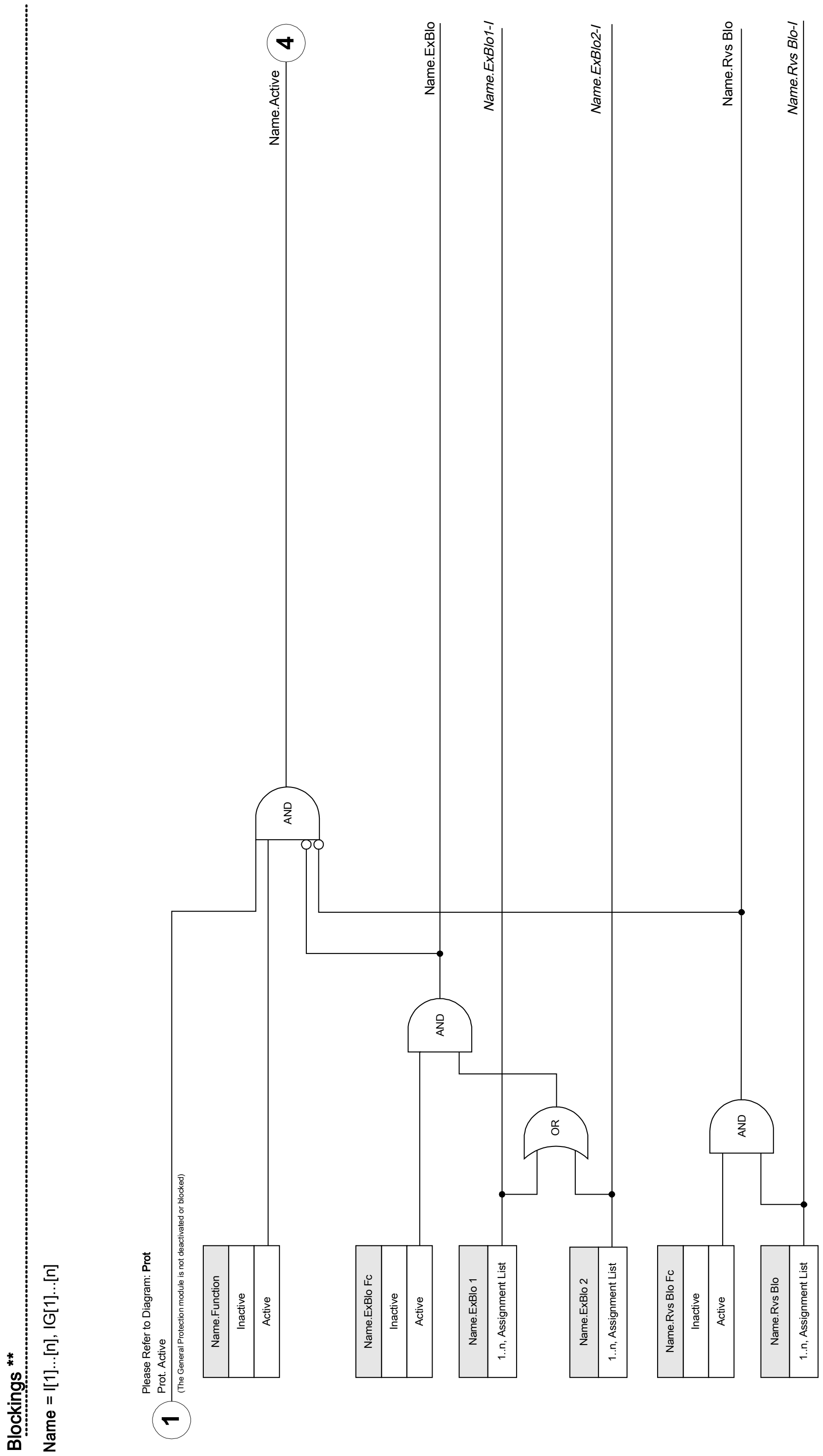


Activate, Deactivate Respectively to Block Temporary Protection Functions



Current protective functions cannot only be blocked permanently (»F*unction* = *Inactive*«) or temporarily by any blocking signal from the »Assignment list«, but also by *»Reverse Interlocking«*.

All other protection functions can be activated, deactivated, or blocked in the same manner.



Module: Protection (Prot)

Prot

The *»Protection«* module serves as the outer frame for all other protection modules (i.e.: they are all enclosed by the *»Protection«* Module).

WARNING **In the case where the *»Protection«* module is blocked, the complete protective function of the device is disabled.**

Module Prot Blocked - Protection Inactive:

If the master *»Protection«* module is allowed to be temporarily blocked and the allocated blocking signals are active, then all protection functions will be disabled. In such a case, the protective function is »Inactive«.

Protection Active:

If the master *»Protection«* **module** was activated and a blockade for this module was not activated respectively, the assigned blocking signals are inactive at that moment, then the *»Protection«* is »Active«.

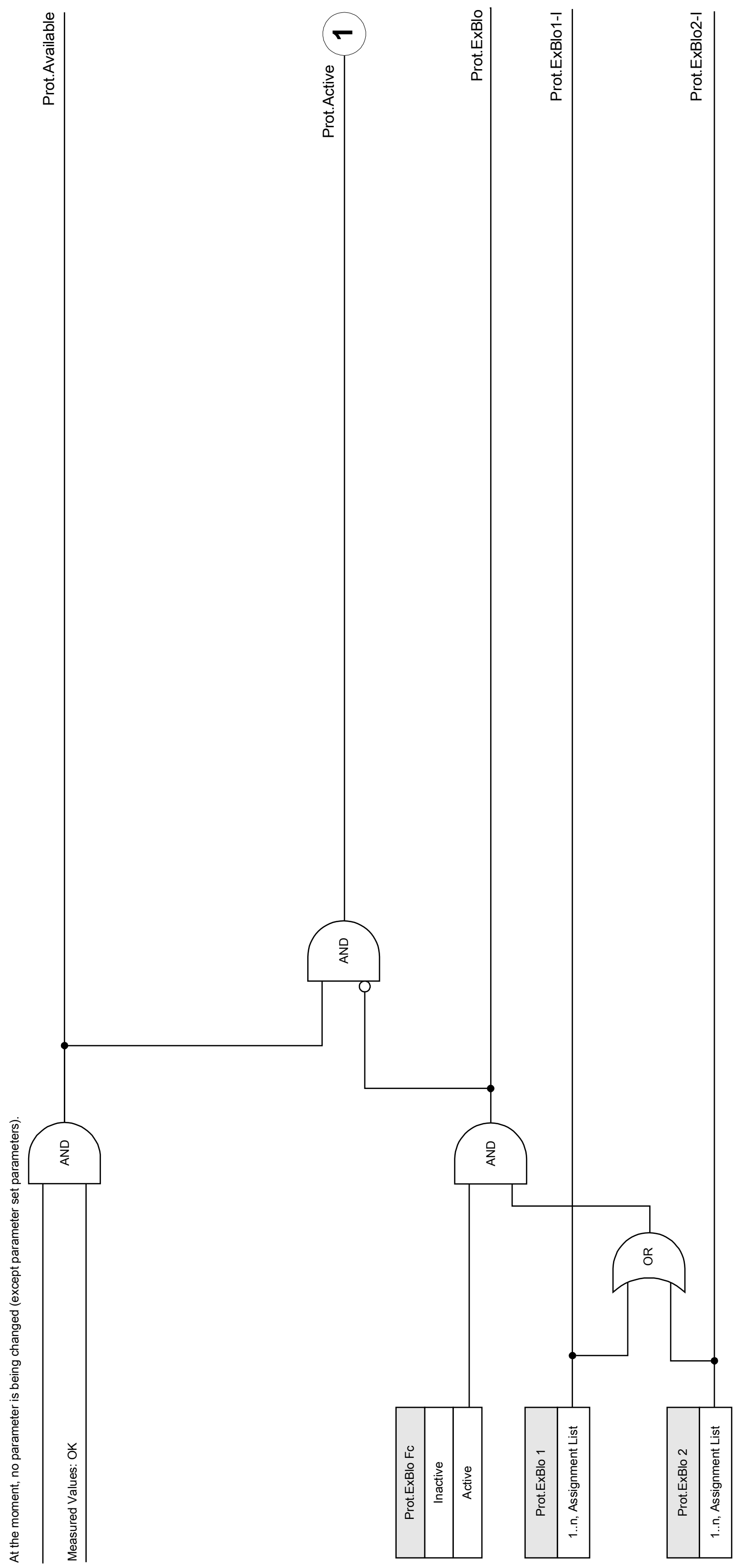
How to Block All Protective and Supervisory Functions

In order to block all protective and supervisory functions, call up the menu [Protection/Para/Global Prot Para/Prot]:

- Set the parameter »*ExBlo Fc = active*«;
- Choose an assignment for »*ExBlo1*«; and
- Optionally choose an assignment for »*ExBlo2*«.

If the signal becomes true, then all protective and supervisory functions will be blocked as long as one of these signals are true.

Prot - Active


Prot.Available
Prot.Active
1
Prot.ExBlo
Prot.ExBlo1-I
Prot.ExBlo2-I
AND
AND
AND
OR
At the moment, no parameter is being changed (except parameter set parameters).
Measured Values: OK
Prot.ExBlo Fc
Inactive
Active
Prot.ExBlo 1
1..n, Assignment List
Prot.ExBlo 2
1..n, Assignment List

Each protection element generates its own pickup and trip signals, which are automatically passed onto the *»Prot«* module where the phase based and general (collective) pickup and trip signals are generated. The *»Prot«* module serves as a top level and a common place to group all pickups and trips from each individual protection element.

For instance, »Prot.Pickup Phase A« is the phase A pickup signal OR-ed from all protection elements; »Prot.Trip Phase A« is the phase A trip signal OR-ed from all protection elements; »Prot.Pickup« is the collective pickup signal OR-ed from all protection elements; Prot.Trip is the collective Trip signal OR-ed from all protection elements, and etc. The Tripping commands of the protection elements have to be fed to the *»Bkr Manager«* module for further trip request processing.

WARNING

The tripping commands are executed by the *»Bkr Manager«* module.
Tripping commands have to be assigned to a breaker. The Breaker Manager will issue the trip command to the breaker.

If a protection element is activated and respectively decides to trip, two pickup signals will be created.

1. The module or the protection element issues an pickup/alarm (e.g.: »50P[1].Pickup or »50P[1].Trip«).
2. The master *»Prot«* module collects/summarizes the signals and issues a pickup/alarm or a trip signal »Prot.Pickup« »Prot.Trip«.

Prot.Trip

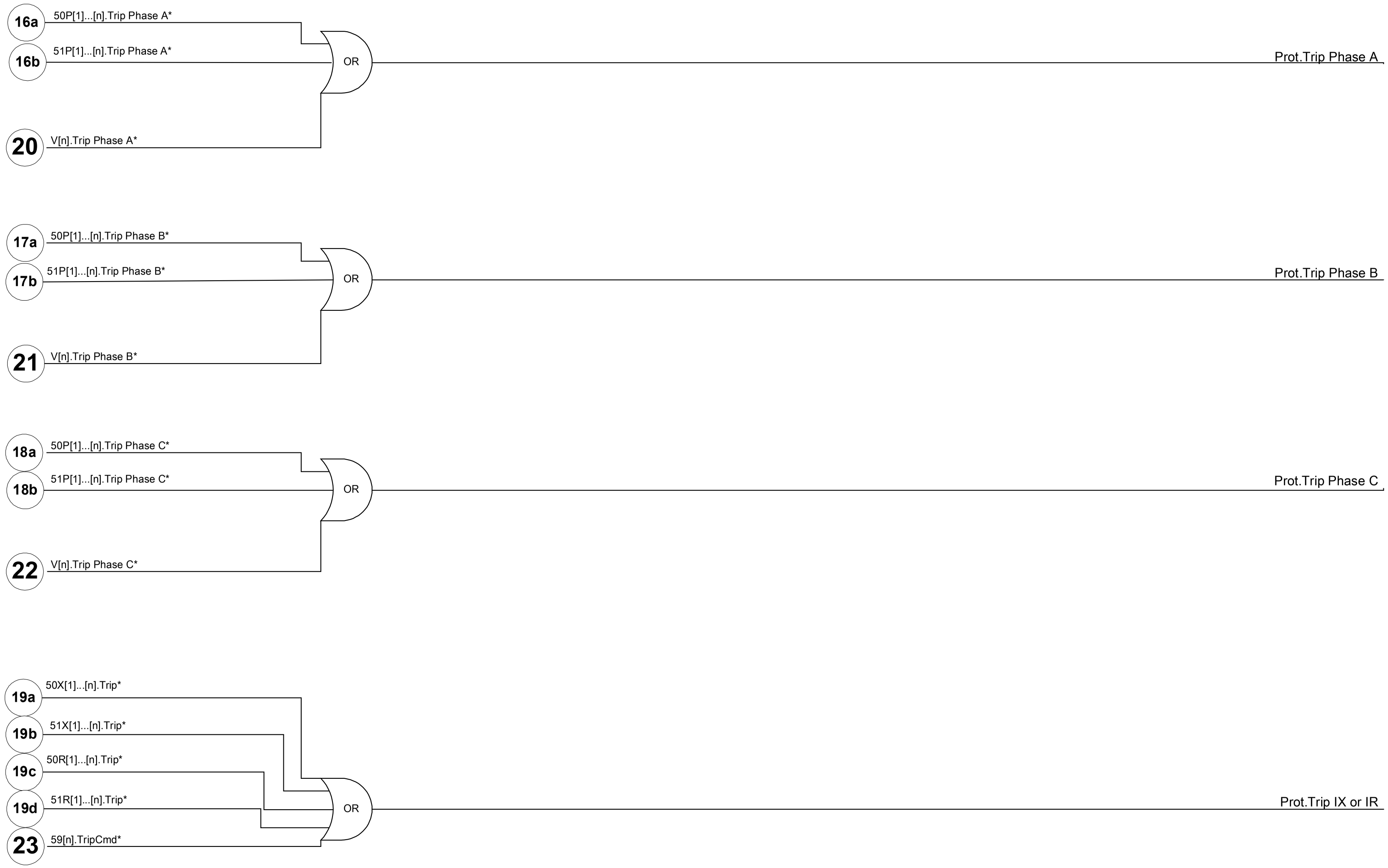
Name = Each trip of an active, trip authorized protection module will lead to a general trip.

Prot.Pickup

Name = Each pickup of a module (except from supervision modules but including BF) will lead to a general pickup (collective pickup).

Prot.Trip

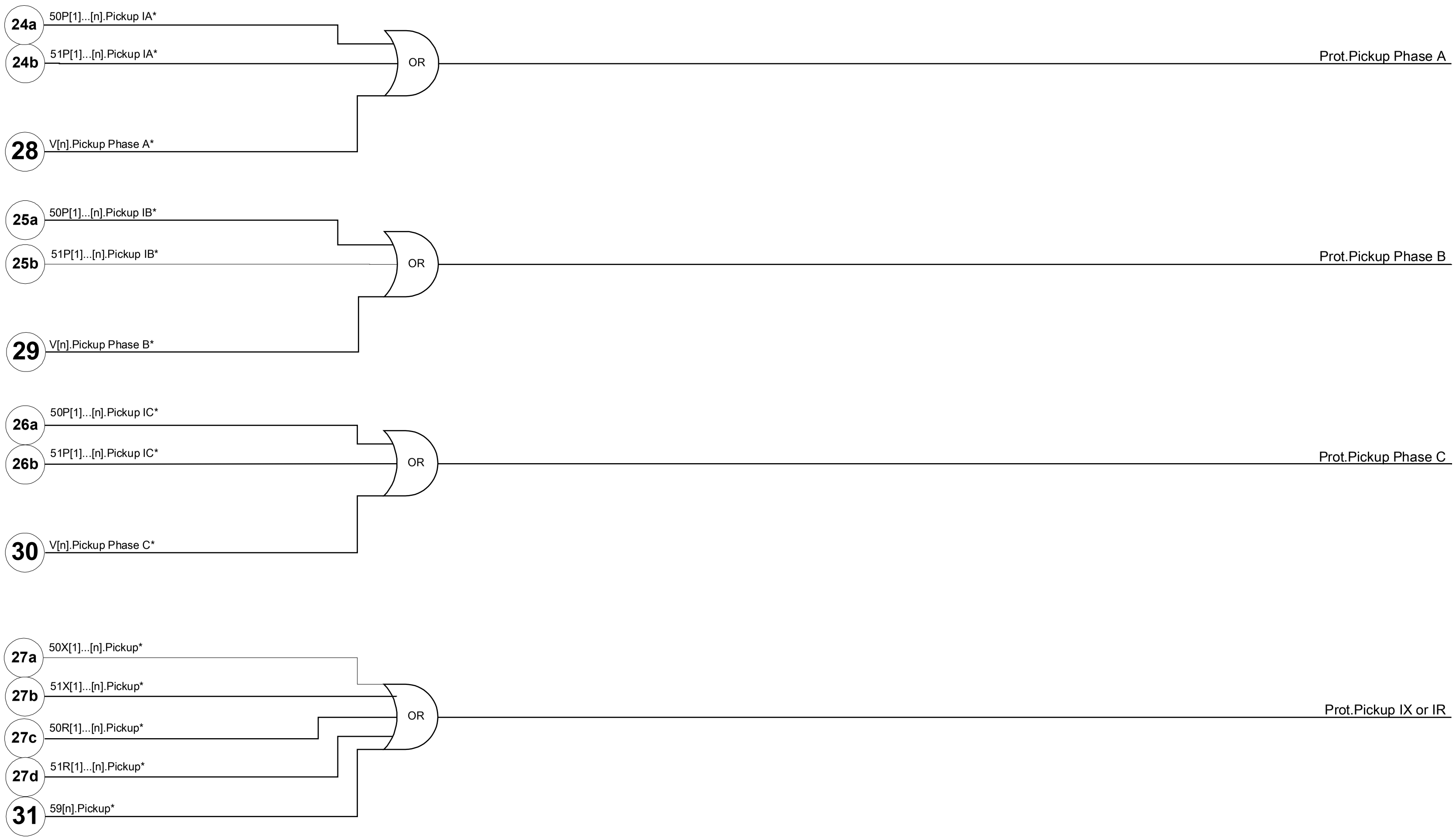
Each phase selective trip of a trip authorized module (I, IG, V, VX depending on the device type) will lead to a phase selective general trip.



*=Depending on the type of device

Prot.Pickup

Each phase selective pickup of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general pickup (collective pickup).



*=Depending on the type of device

Direct Commands of the Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Res Fault a Mains No	Resetting of fault number and number of grid faults.	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo Fc	Activate (allow) the external blocking of the global protection functionality of the device.	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Prot]
ExBlo1	If external blocking of this module is activated (allowed), the global protection functionality of the device will be blocked if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Prot]
ExBlo2	If external blocking of this module is activated (allowed), the global protection functionality of the device will be blocked if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Prot]

Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Prot]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Prot]

Protection Module Signals (Output States)

Name	*Description*
Available	Signal: Protection is available.
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup Phase A	Signal: General Pickup Phase A
Pickup Phase B	Signal: General Pickup Phase B
Pickup Phase C	Signal: General Pickup Phase C
Pickup IX or IR	Signal: General Pickup - Ground Fault
Pickup	Signal: General Pickup
Trip Phase A	Signal: General Trip Phase A
Trip Phase B	Signal: General Trip Phase B
Trip Phase C	Signal: General Trip Phase C
Trip IX or IR	Signal: General Trip Ground Fault
Trip	Signal: General Trip
Res Fault a Mains No	Signal: Resetting of fault number and number of grid faults.

Protection Module Values

Value	*Description*	*Menu Path*
FaultNo	Disturbance No.	[Operation /Count and RevData /Prot]
No of grid faults	Number of grid faults: A grid fault, e.g. a short circuit, might cause several faults with trip and autoreclosing, each fault being identified by an increased fault number. In this case, the grid fault number remains the same.	[Operation /Count and RevData /Prot]

Breaker (Manager)

Principle – General Use

By means of this module [Protection Para/Global Prot Para/Bkr Manager], the breaker is managed. That means:

•Assign the signal that represents the wired 52a contact (minimum requirement);

•Assign the signal that represents the wired 52b contact (recommendation);

•Assign the signal that represents »*Manual Close*« command
(This digital input can be used by some protective elements (if they are available within the device) like Switch Onto Fault (SOTF), e.g. as a trigger signal.);

•Assign the signal that represents »*Manual Open*« command;
(This digital input can be used by some protective elements (if they are available within the device) like Cold Load Pickup (CLPU), e.g. as a trigger signal.)

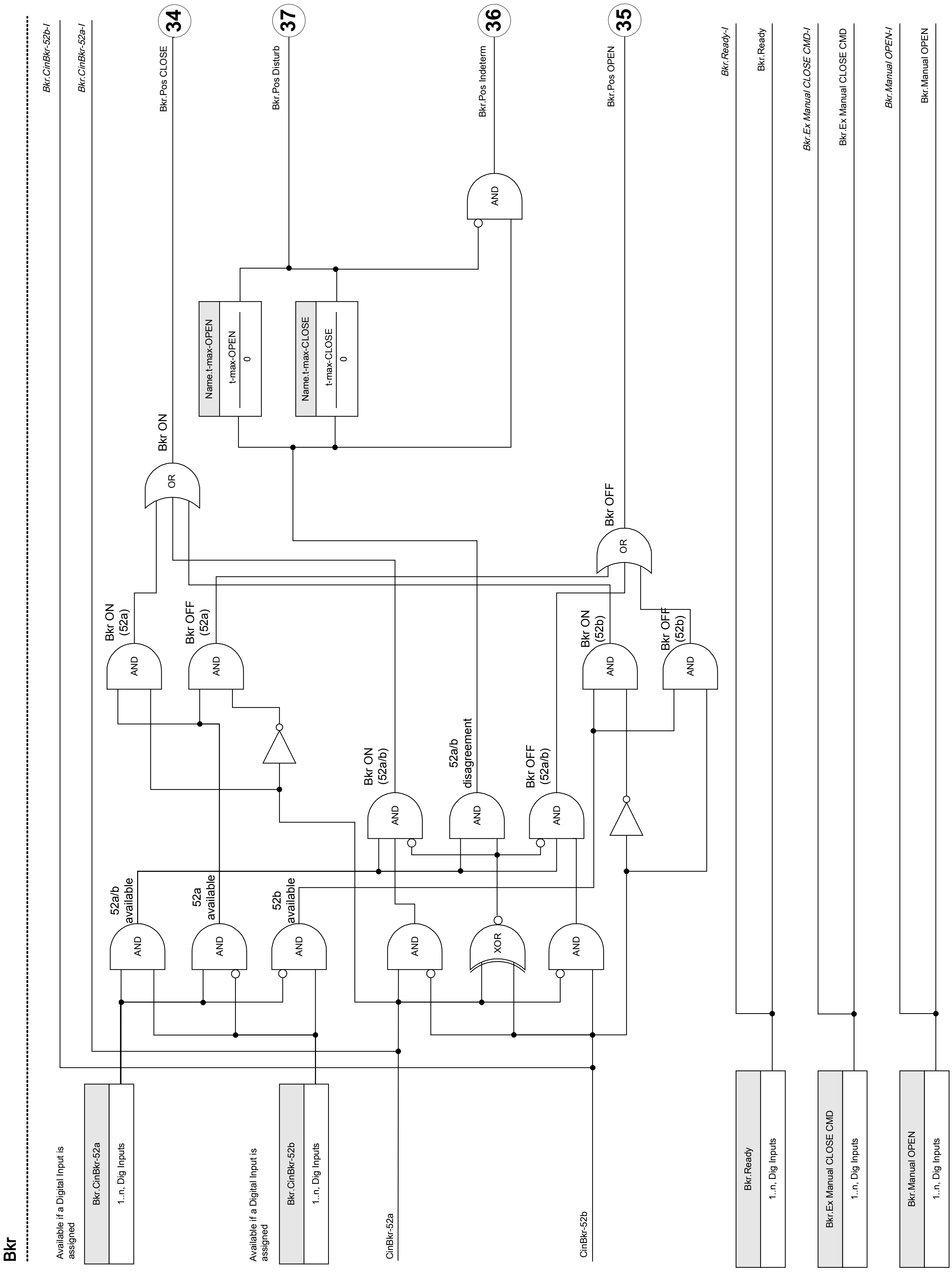
•Assign the signal that represents »*Bkr ready«;*
(This digital input can be used by some protective elements (if they are available within the device) like Auto Reclosure (AR), e.g. as a trigger signal.)

•Determine whether the Open command is latched;

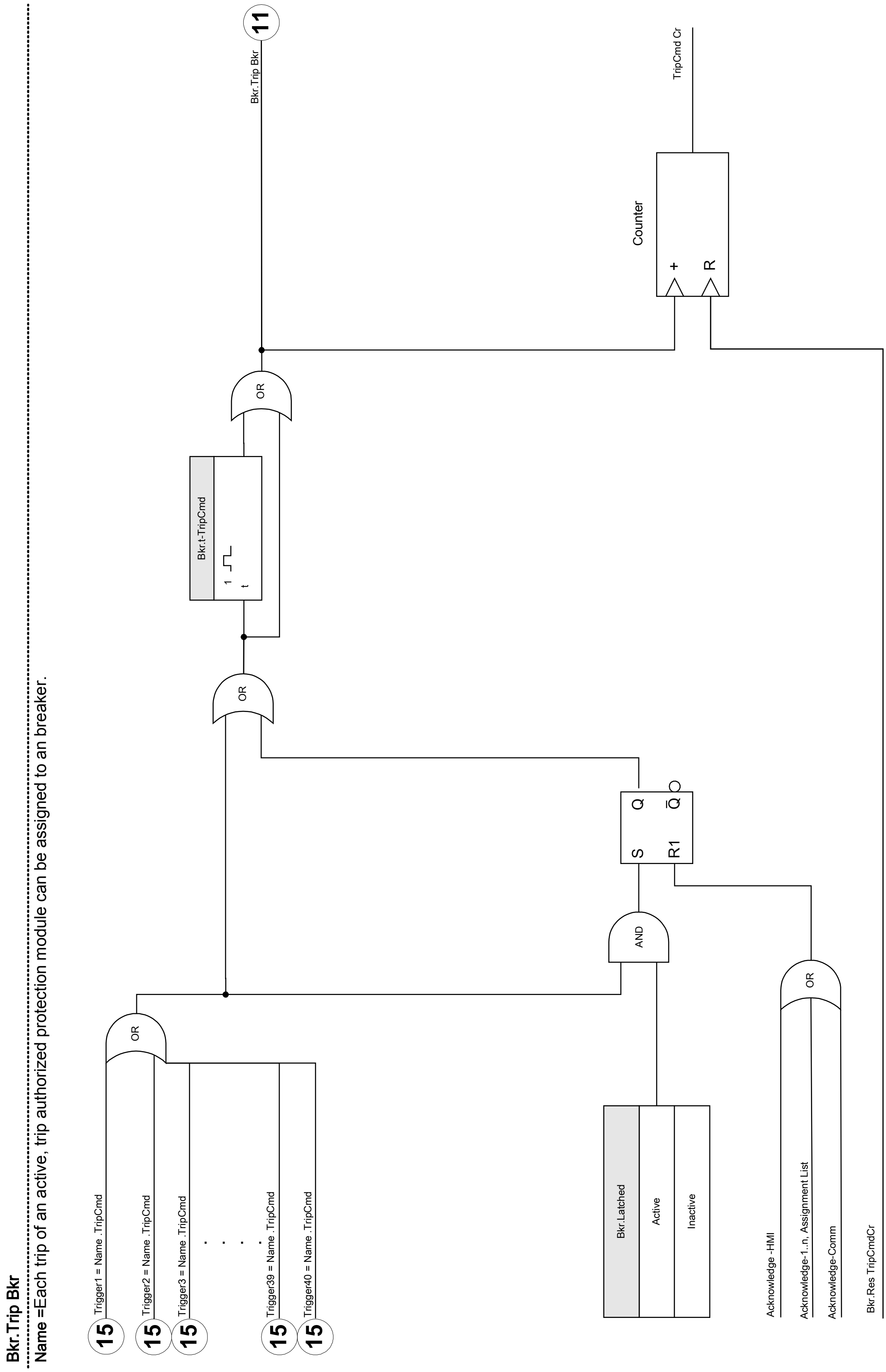
•Determine the minimum hold time of the tripping command; and

•Determine which trip decisions of protection modules should be issued to the breaker. The command for tripping can come from each of the protection modules, but the actual tripping command to the breaker is only given by the *»Bkr«* module. Therefore the User can assign up to 40 trip decisions. Those will be issued to the breaker by an “OR” logic.

Configuration of a Breaker



Assignment of the Trip Commands



50P- DEFT Overcurrent Protection Module [ANSI 50P]

Elements
50P[1] ,50P[2] ,50P[3]

WARNING **If using inrush blockings, the tripping delay of the current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All overcurrent protective elements are identically structured.**

For each element the following characteristic is available:

•DEFT (definite time).

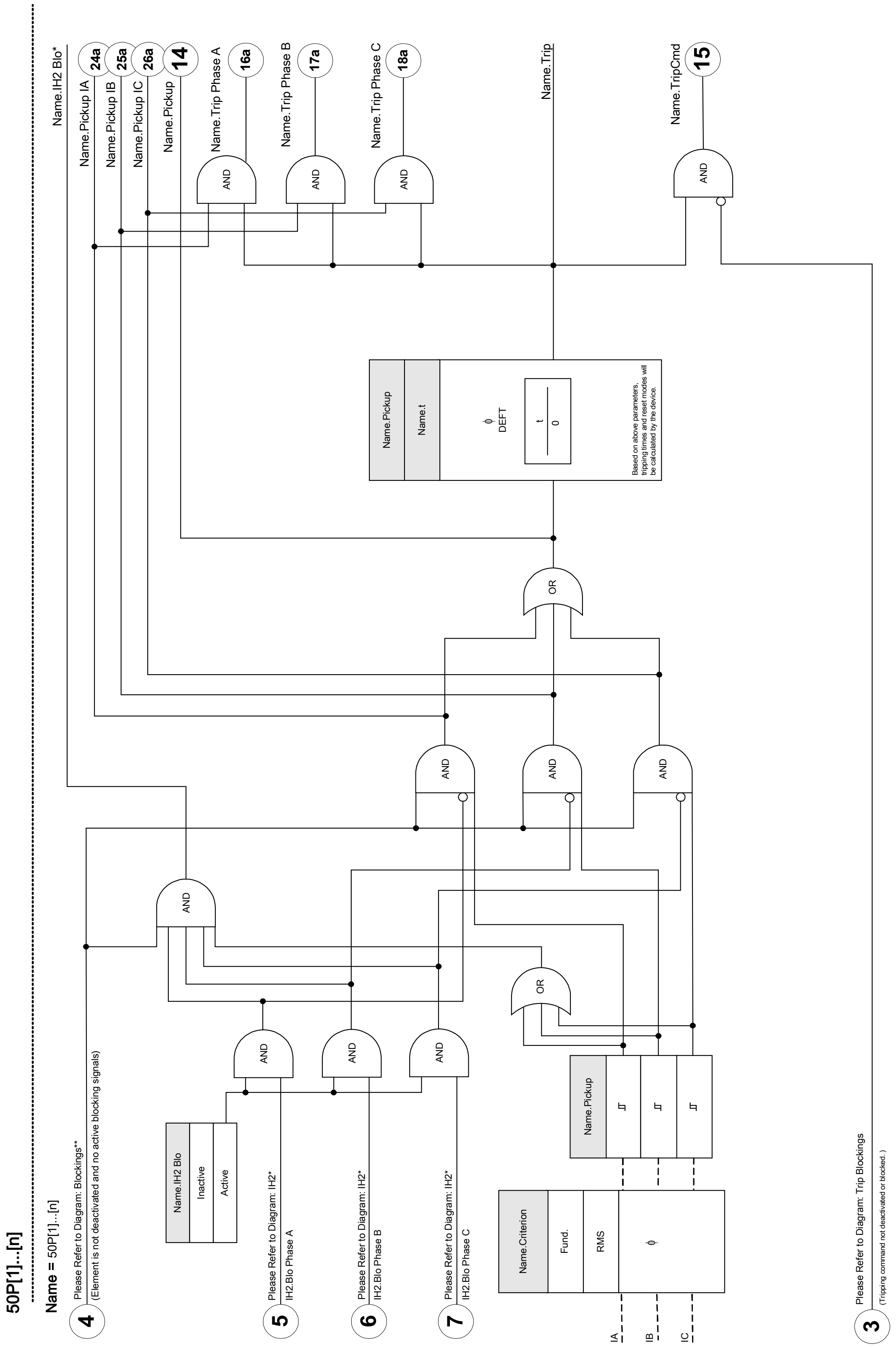
Explanation
t = Tripping delay

I = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

This element offers a criterion setting. The criterion setting tells if the threshold is based on the fundamental (Phasor) or RMS.

For Tripping curves, please refer to the “Appendix/Instantaneous Current Curves (Phase)” section.



*=Applies only to devices that offer Inrush Protection

Device Planning Parameters of the 50P Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	50P[1]: Non-directional 50P[2]: Non-directional 50P[3]: Do not use, Non-directional	Non-directional	[Device Planning]

Global Protection Parameters of the 50P Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50P[1]]

Setting Group Parameters of the 50P Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	50P[1]: Active 50P[2]: Active 50P[3]: Inactive	[Protection Para /<n> /I-Prot /50P[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50P[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /50P[1]]
Pickup 	If the pickup value is exceeded, the module/element starts to time out to trip. Only available if: Characteristic = DEFT Or Characteristic = INV Minimum of the setting range If: VRestraint = Active Minimum of the setting range If: VRestraint = Inactive	0.02 - 40.00In	50P[1]: 2In 50P[2]: 2.5In 50P[3]: 3.0In	[Protection Para /<n> /I-Prot /50P[1]]
t 	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	50P[1]: 0s 50P[2]: 0.25s 50P[3]: 0.25s	[Protection Para /<n> /I-Prot /50P[1]]

50P Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /50P[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /50P[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /50P[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /50P[1]]

50P Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup IA	Signal: Pickup IA
Pickup IB	Signal: Pickup IB
Pickup IC	Signal: Pickup IC
Pickup	Signal: Pickup
Trip Phase A	Signal: General Trip Phase A
Trip Phase B	Signal: General Trip Phase B
Trip Phase C	Signal: General Trip Phase C
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Overcurrent Protection, Non-directional [ANSI 50P]

Object to be tested:

•Signals to be measured for each current protection element: the threshold values, total tripping time (recommended), or alternatively tripping delays and the drop-out ratios; each time 3 x single-phase and 1 x three-phase.

NOTICE

Eaton recommends measuring the total tripping time instead of the tripping delay. The tripping delay should be specified by the User. The total tripping time is measured at the position signaling contact of the breaker (not at the relay output contacts!).

Total tripping time = tripping delay (please refer to the tolerances of the protection elements)
+ breaker operating time (about 50 ms)

Please take the breaker operating times from the technical data specified in the relevant documentation provided by the breaker manufacturer.

Necessary means:

•Current source;
•Current meters; and
•Timer.

Procedures:

Testing the threshold values (3 x single-phase and 1 x three-phase)
For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check the threshold values.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the breaker (breaker tripping).

Testing the tripping delay (measuring at the relay output contact)
Measure the tripping times at the relay output contact.

Testing the drop-out ratio
Reduce the current to 97% below the trip value and check the drop-out ratio.

Successful test result
The measured total tripping delays or individual tripping delays, threshold values, and drop-out ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found in the Technical Data section.

51P - INV Overcurrent-Protection Module [ANSI 51P]

Elements
51P[1]

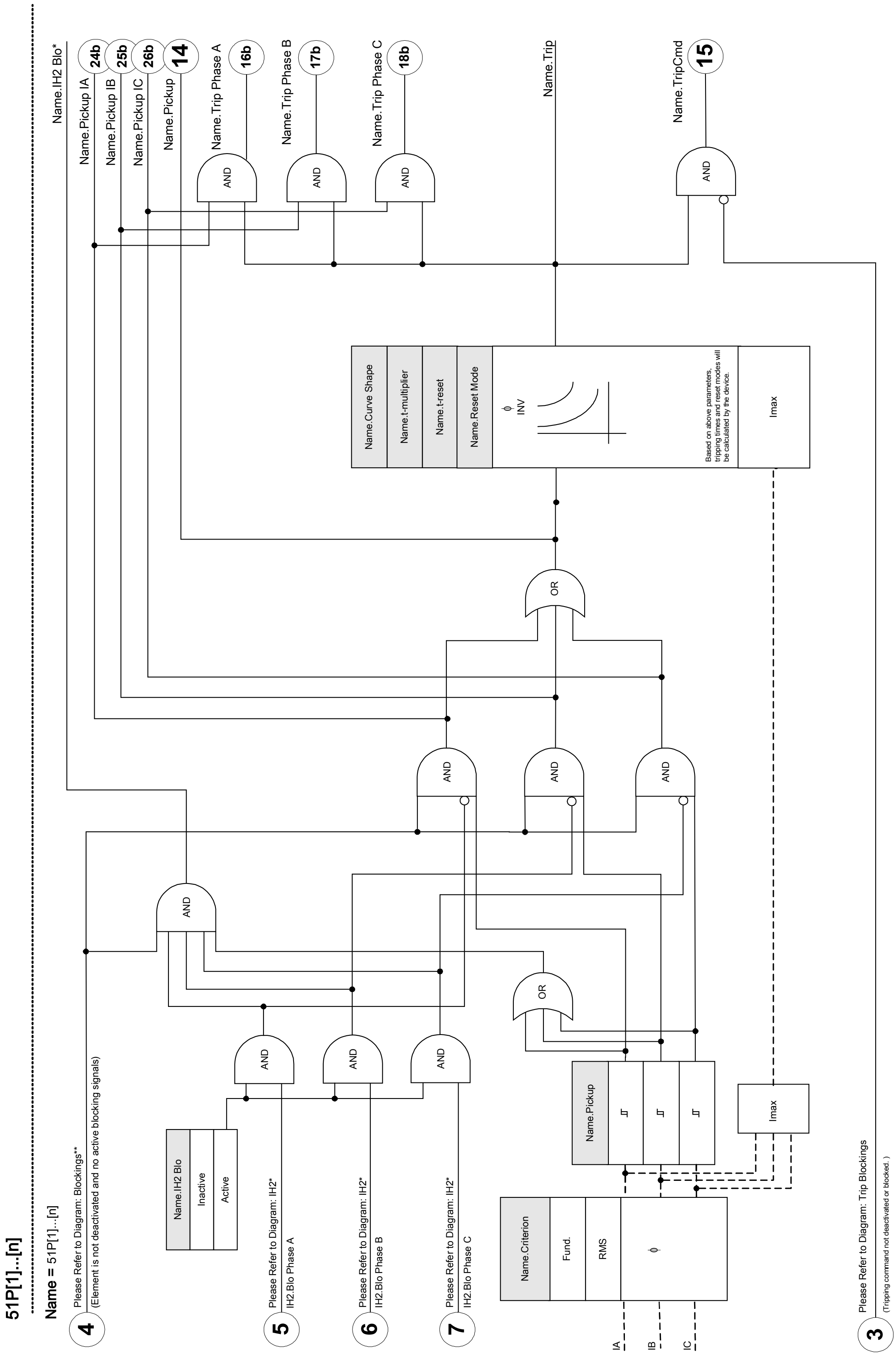
WARNING **If using inrush blockings, the tripping delay of the current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All overcurrent protective elements are identically structured.**

For each element, the following characteristics are available:

•NINV (IEC/XInv);
•VINV (IEC/XInv);
•LINV (IEC/XInv);
•EINV (IEC/XInv);
•MINV (ANSI/XInv);
•VINV (ANSI/XInv);
•EINV (ANSI/XInv);
•Thermal Flat;
•Therm Flat IT;
•Therm Flat I2T; and
•Therm Flat I4T.

For tripping curves please refer to the “Appendix/Time Current Curves (PHASE)” section.



*=Applies only to devices that offer Inrush Protection

Device Planning Parameters of the 51P Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

Global Protection Parameters of the 51P Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[1]]

Setting Group Parameters of the 51P Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /I-Prot /51P[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /51P[1]]
Pickup	If the pickup value is exceeded, the module/element starts to time out to trip. Minimum of the setting range If: VRestraint = Active Minimum of the setting range If: VRestraint = Inactive	0.02 - 40.00In	1.00In	[Protection Para /<n> /I-Prot /51P[1]]
Curve Shape	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51P[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-multiplier	Time multiplier/tripping characteristic factor	0.02 - 20.00	1	[Protection Para /<n> /I-Prot /51P[1]]
Reset Mode	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51P[1]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Available if:Reset Mode = t-delay	0.00 - 60.00s	0s	[Protection Para /<n> /I-Prot /51P[1]]

51P Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51P[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51P[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51P[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51P[1]]

51P Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup IA	Signal: Pickup IA
Pickup IB	Signal: Pickup IB
Pickup IC	Signal: Pickup IC
Pickup	Signal: Pickup
Trip Phase A	Signal: General Trip Phase A
Trip Phase B	Signal: General Trip Phase B
Trip Phase C	Signal: General Trip Phase C
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Overcurrent Protection, Non-directional [ANSI 51P]

Object to be tested

- Signals to be measured for each current protection element: the threshold values, total tripping time (recommended), or alternatively tripping delays and the drop-out ratios; each time 3 x single-phase and 1 x three-phase.

NOTICE

Eaton recommends measuring the total tripping time instead of the tripping delay. The tripping delay should be specified by the User. The total tripping time is measured at the position signaling contact of the breaker (not at the relay output contacts!).

Total tripping time = tripping delay (please refer to the tolerances of the protection stages)
+ breaker operating time (about 50 ms)

Please take the breaker operating times from the technical data specified in the relevant documentation provided by the breaker manufacturer.

Necessary means:

•Current source;
•Current meters; and
•Timer.

Procedure:

Testing the threshold values (3 x single-phase and 1 x three-phase)
For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check the threshold values.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the breaker (breaker tripping).

Testing the tripping delay (measuring at the relay output contact)
Measure the tripping times at the relay output contact.

Testing the drop-out ratio
Reduce the current to 97% below the trip value and check the drop-out ratio.

Successful test result
The measured total tripping delays or individual tripping delays, threshold values, and drop-out ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found in the Technical Data section.

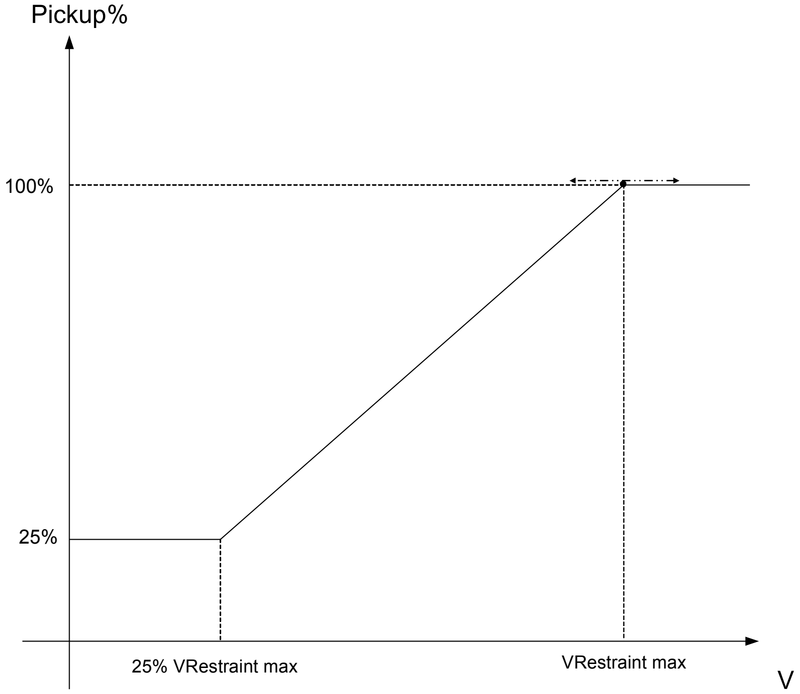
51V – Voltage Restraint Overcurrent-Protection Module

Elements
51P[2] ,51P[3]

NOTICE **All voltage restraint overcurrent protective elements are identically structured.**

The *51V* element restrains operation which reduces pickup levels. This allows the User to lower the pickup value of the *51V* elements with the corresponding phase input voltage (phase-to-phase or phase-to-ground, depending on the setting of »*Main VT con*« within the System Parameters). When the minimum fault phase current is close to the load current, it may make the phase time overcurrent protection coordination difficult. In this case, an undervoltage function may be used to alleviate this situation. When the voltage (RMS) is low, the phase time overcurrent pickup threshold may be set low accordingly, so that the phase time overcurrent protection may achieve adequate sensitivity and better coordination. The device uses a simple linear model to determine the effective pickup by characterizing the relationship between the voltage and the phase time overcurrent pickup threshold.

Once the voltage restraint is activated, the effective phase time overcurrent pickup threshold will be the calculated Pickup% times the phase time overcurrent pickup setting. The effective pickup threshold must be within the setting range allowed and, if it is less, the minimum pickup value will be used.



That means:

- •Vmin = 0.25*Vmax;
- •Pickup%min = 25%;
- •Pickup% = 25%, if V <= Vmin;
- •Pickup% = 1/Vmax*(V - Vmin) + 25%, if Vmin < V < Vmax;
- •Pickup% = 100%, if V >= Vmax;

For tripping curves, please refer to the“Appendix/Instantaneous Current Curves (Phase)” section.

If this element should be blocked in case of a Loss Of Potential, »LOP BLO« has to be set to »*active*«.

NOTICE

Definition of Vn: Vn is dependent on the System Parameter setting of "Main VT con".

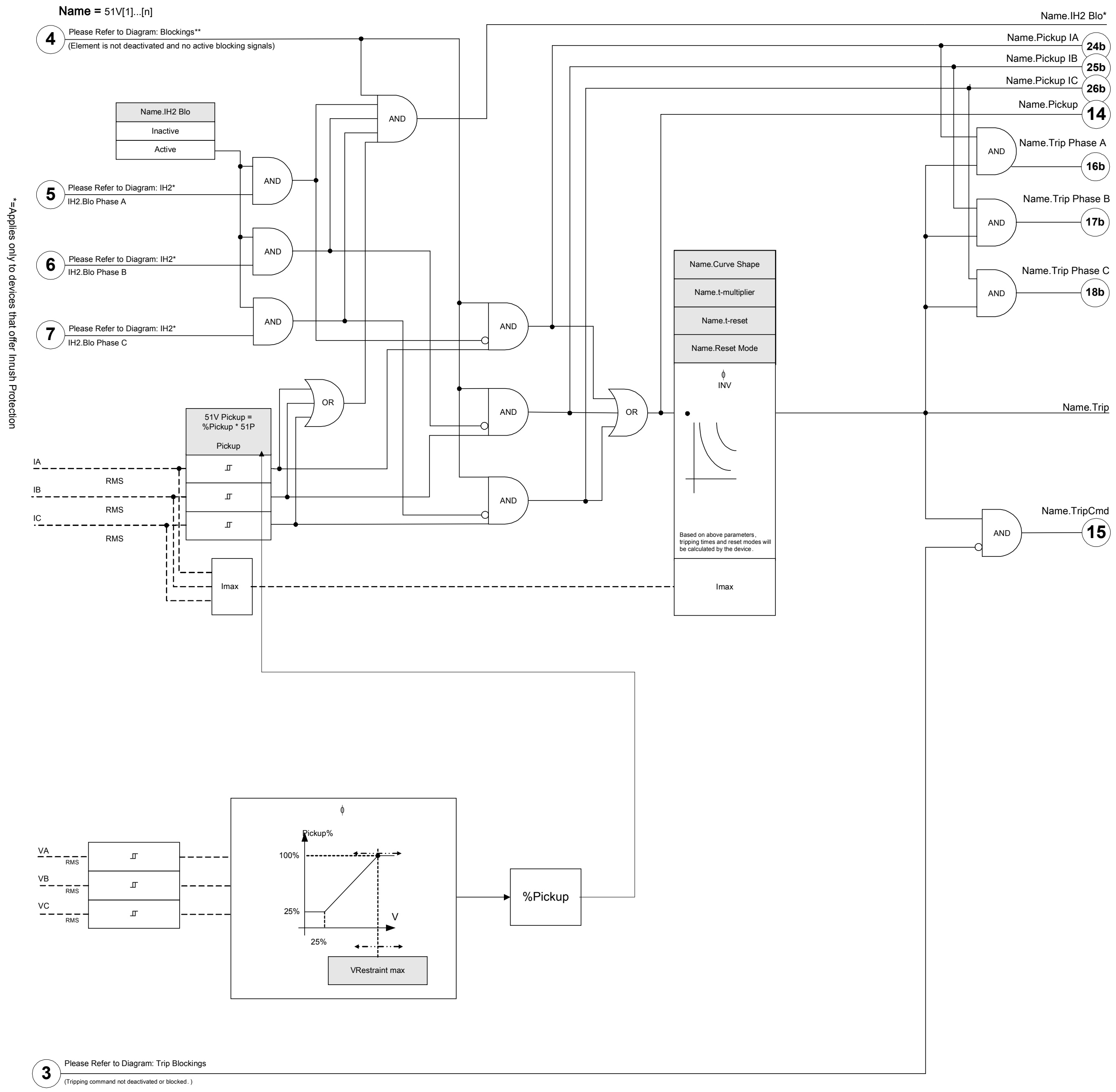
In case that within the System Parameters "Main VT con" is set to "Open-Delta":

$$Vn = Main\,VT\,sec \quad .$$

In case that "Main VT con" is set to "Wye":

$$Vn = \frac{Main\,VT\,sec}{\sqrt{3}}$$

51V[1]...[n]



Device Planning Parameters of the 51V Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Non-directional	Non-directional	[Device Planning]

Global Protection Parameters of the 51V Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51P[2]]

Setting Group Parameters of the 51V Module

NOTICE

In the case that Voltage Restraint is active (Vrestraint=active), the minimum pickup that can be set is 0.1 In.

In the case that Voltage Restraint is inactive (Vrestraint=inactive), the minimum pickup that can be set is 0.01 In.

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	51P[2]: Active 51P[3]: Inactive	[Protection Para /<n> /I-Prot /51P[2]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[2]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[2]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[2]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[2]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /51P[2]]
Pickup 	If the pickup value is exceeded, the module/element starts to time out to trip. Minimum of the setting range If: VRestraint = Active Minimum of the setting range If: VRestraint = Inactive	0.02 - 40.00In	1.00In	[Protection Para /<n> /I-Prot /51P[2]]
Curve Shape 	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51P[2]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-multiplier	Time multiplier/tripping characteristic factor	0.02 - 20.00	51P[2]: 2 51P[3]: 3	[Protection Para /<n> /I-Prot /51P[2]]
Reset Mode	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51P[2]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Available if:Reset Mode = t-delay	0.00 - 60.00s	0s	[Protection Para /<n> /I-Prot /51P[2]]
VRestraint	Voltage Restraint Protection	Inactive, Active	Active	[Protection Para /<n> /I-Prot /51P[2]]
VRestraint max	Maximum voltage restraint level. Definition of Vn: Vn is dependent on the System Parameter setting of "Main VT con". In case that within the System Parameters "Main VT con" is set to "Open-Delta" , "Vn = Main VT sec ". In case that "Main VT con" is set to "Wye", "Vn = Main VT sec/SQRT(3)". Only available if: VRestraint = Active	0.04 - 2.00Vn	1.00Vn	[Protection Para /<n> /I-Prot /51P[2]]
LOP Blo	Blocking if voltage transformer failure detected. LOP (Loss of Potential) Only available if: VRestraint = Active	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51P[2]]

51V Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51P[2]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51P[2]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51P[2]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51P[2]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51P[2]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51P[2]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51P[2]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51P[2]]

51V Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup IA	Signal: Pickup IA
Pickup IB	Signal: Pickup IB
Pickup IC	Signal: Pickup IC
Pickup	Signal: Pickup
Trip Phase A	Signal: General Trip Phase A
Trip Phase B	Signal: General Trip Phase B
Trip Phase C	Signal: General Trip Phase C
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Overcurrent Protection, Non-directional [ANSI 51P]

Object to be tested:

Signals to be measured for Voltage Restraint element: the threshold values, total tripping time (recommended), or alternatively tripping delays and the dropout ratios; each time 3 x single-phase and 1 x three-phase.

•

NOTICE

Eaton recommends measuring the total tripping time instead of the tripping delay. The tripping delay should be specified by the customer. The total tripping time is measured at the position signaling contact of the breaker (not at the relay output contacts!).

Total tripping time = tripping delay (please refer to the tolerances of the protection stages) + breaker operating time (about 50 ms)

Please take the breaker operating times from the technical data specified in the relevant documentation provided by the breaker manufacturer.

Necessary means:

- Current source;
- Voltage Source;
- Current and Voltage meters; and
- Timer.

Procedure:

Testing the threshold values (3 x single-phase and 1 x three-phase)
Feed %Pickup voltage. For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check if the pickup values are %Pickup of the value according to 51P protection.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the breakers (breaker tripping).

Testing the tripping delay (measuring at the relay output contact)
Measure the tripping times at the relay output contact.

Testing the dropout ratio
Reduce the current to 97% below the trip value and check the dropout ratio.

Successful test result
The measured total tripping delays or individual tripping delays, threshold values, and dropout ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

50X DEFT Measured Ground Fault Protection Module – [ANSI 50X]

Elements
50X[1] ,50X[2]

WARNING **If using inrush blockings, the tripping delay of the ground current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

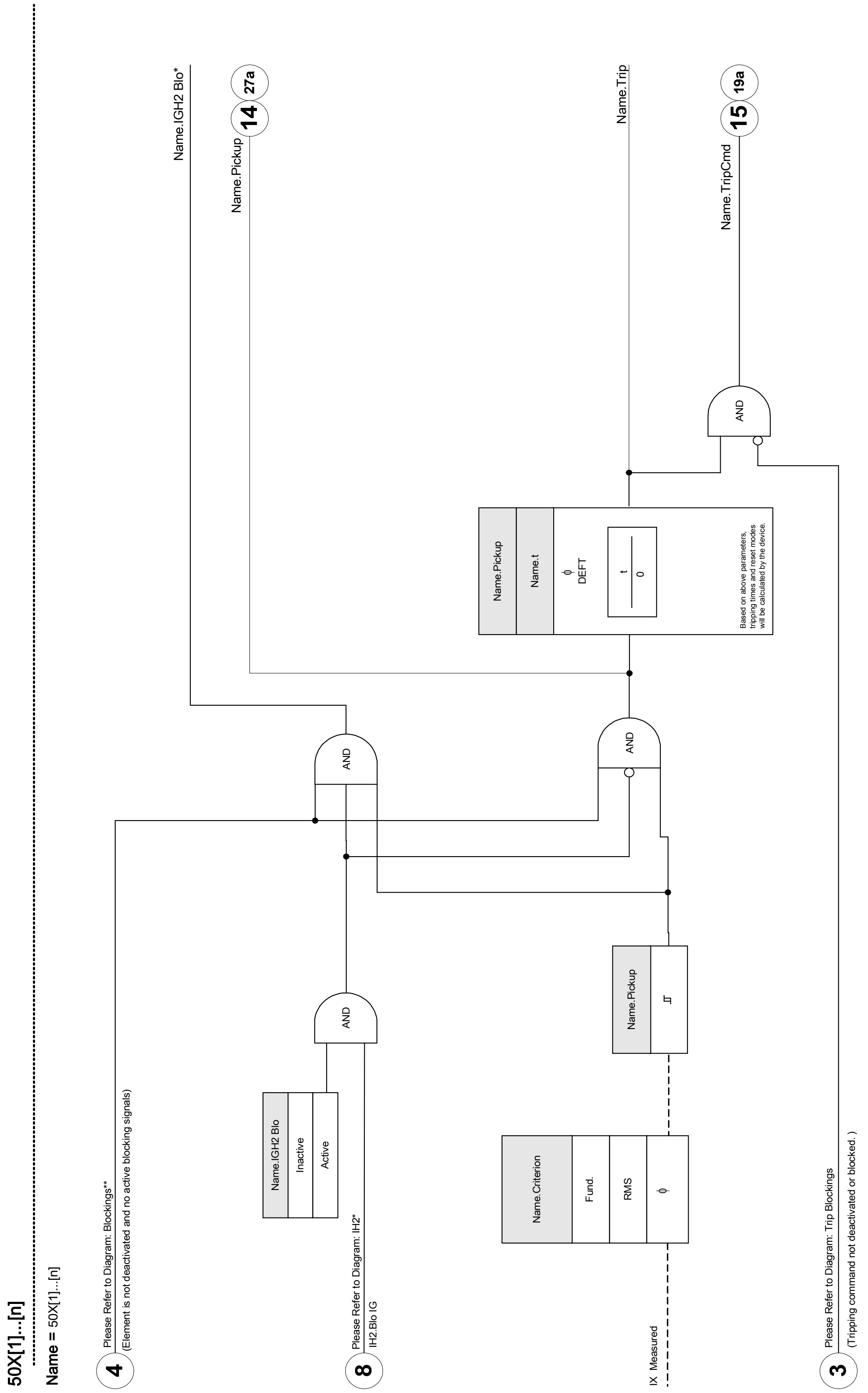
NOTICE **All ground current elements are identically structured.**

For each element the following characteristics are available:

•DEFT (definite time).

For tripping curves please refer to the “Appendix/Instantaneous Current Curves (Ground Current Measured)” section.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents. However, this is only possible if the current transformers are Wye-connected.



*=Applies only to devices that offer Inrush Protection

Device Planning Parameters of the 50X Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

Global Protection Parameters of the 50X Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50X[1]]

Setting Group Parameters of the 50X Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /I-Prot /50X[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50X[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /50X[1]]
Pickup	If the pickup value is exceeded, the module/element will be started. Only available if: Characteristic = DEFT Or Characteristic = INV	0.02 - 20.00In	50X[1]: 1In 50X[2]: 2In	[Protection Para /<n> /I-Prot /50X[1]]
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	0.5s	[Protection Para /<n> /I-Prot /50X[1]]

50X Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /50X[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /50X[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /50X[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /50X[1]]

50X Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 50X]

Please test the non-directional ground overcurrent analog to the non-directional phase overcurrent protection.

51X INV Measured Ground Fault Protection Module [ANSI 51X]

Elements
51X[1] ,51X[2]

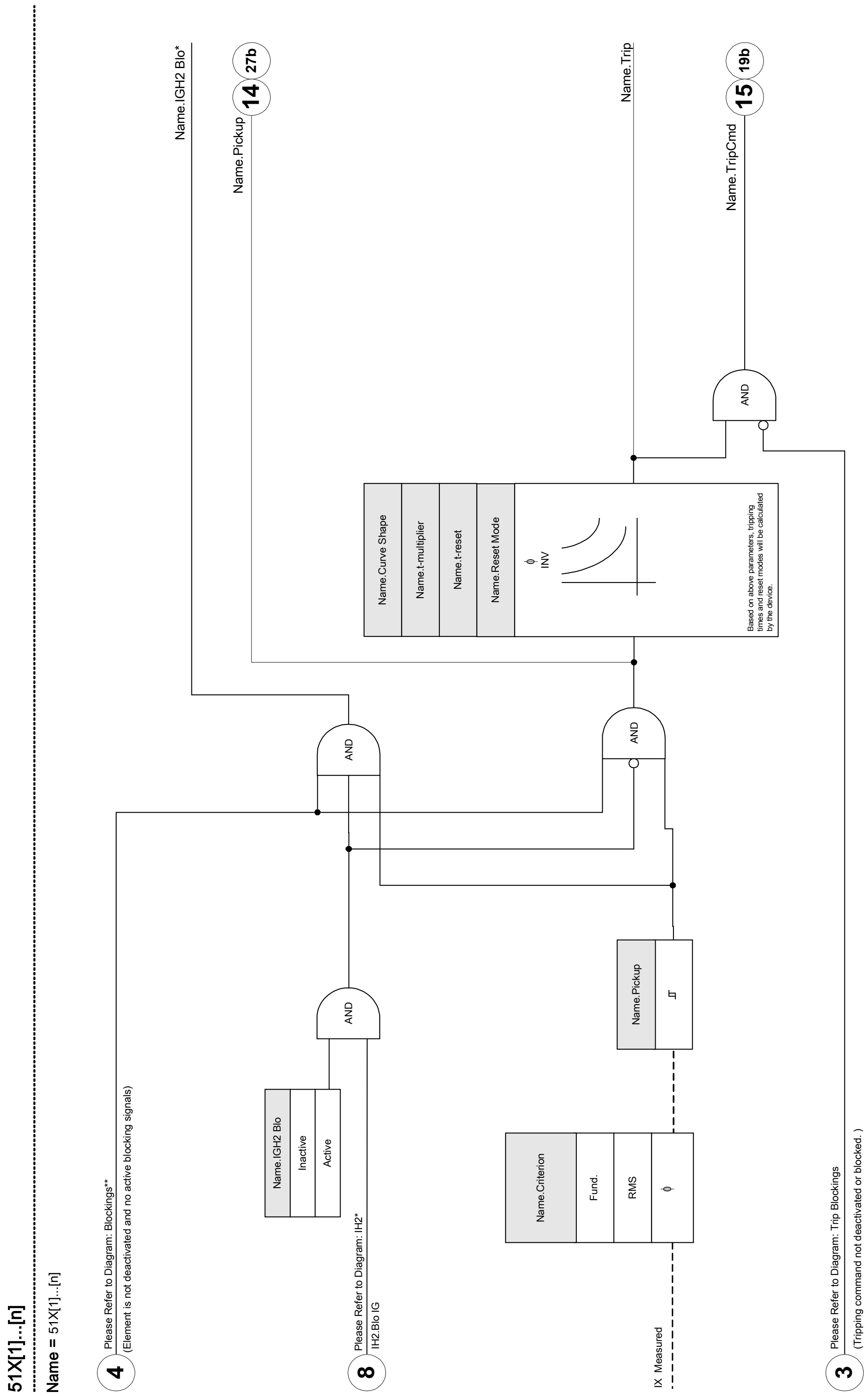
NOTICE **All ground current elements are identically structured.**

For each element the following characteristics are available:

•NINV (IEC/XInv);
•VINV (IEC/XInv);
•LINV (IEC/XInv);
•EINV (IEC/XInv);
•MINV (ANSI/XInv);
•VINV (ANSI/XInv);
•EINV (ANSI/XInv);
•Thermal Flat;
•Therm Flat IT;
•Therm Flat I2T; and
•Therm Flat I4T.

For tripping curves please refer to the “Appendix/Time Current Curves (Ground Current)” section.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents. However, this is only possible if the current transformers are Wye-connected.



*=Applies only to devices that offer Inrush Protection

Device Planning Parameters of the 51X Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	51X[1]: Non-directional 51X[2]: Do not use, Non-directional	Non-directional	[Device Planning]

Global Protection Parameters of the 51X Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51X[1]]

Setting Group Parameters of the 51X Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /I-Prot /51X[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51X[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /51X[1]]
Pickup	If the pickup value is exceeded, the module/element will be started.	0.02 - 20.00In	0.5In	[Protection Para /<n> /I-Prot /51X[1]]
Curve Shape	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51X[1]]
t-multiplier	Time multiplier/tripping characteristic factor	0.02 - 20.00	51X[1]: 1 51X[2]: 2	[Protection Para /<n> /I-Prot /51X[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset Mode	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51X[1]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Only available if:Reset Mode = t-delay	0.00 - 60.00s	0.00s	[Protection Para /<n> /I-Prot /51X[1]]

51X Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51X[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51X[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51X[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51X[1]]

51X Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 51X]

Please test the non-directional ground overcurrent analog to the non-directional phase overcurrent protection.

50R DEFT Calculated Ground Fault Protection Module [ANSI 50R]

Elements
50R[1] ,50R[2]

WARNING **If using inrush blockings, the tripping delay of the ground current protection functions must be at least 30 ms or more in order to prevent faulty trippings.**

NOTICE **All ground current elements are identically structured.**

For each element, the following characteristics are available:

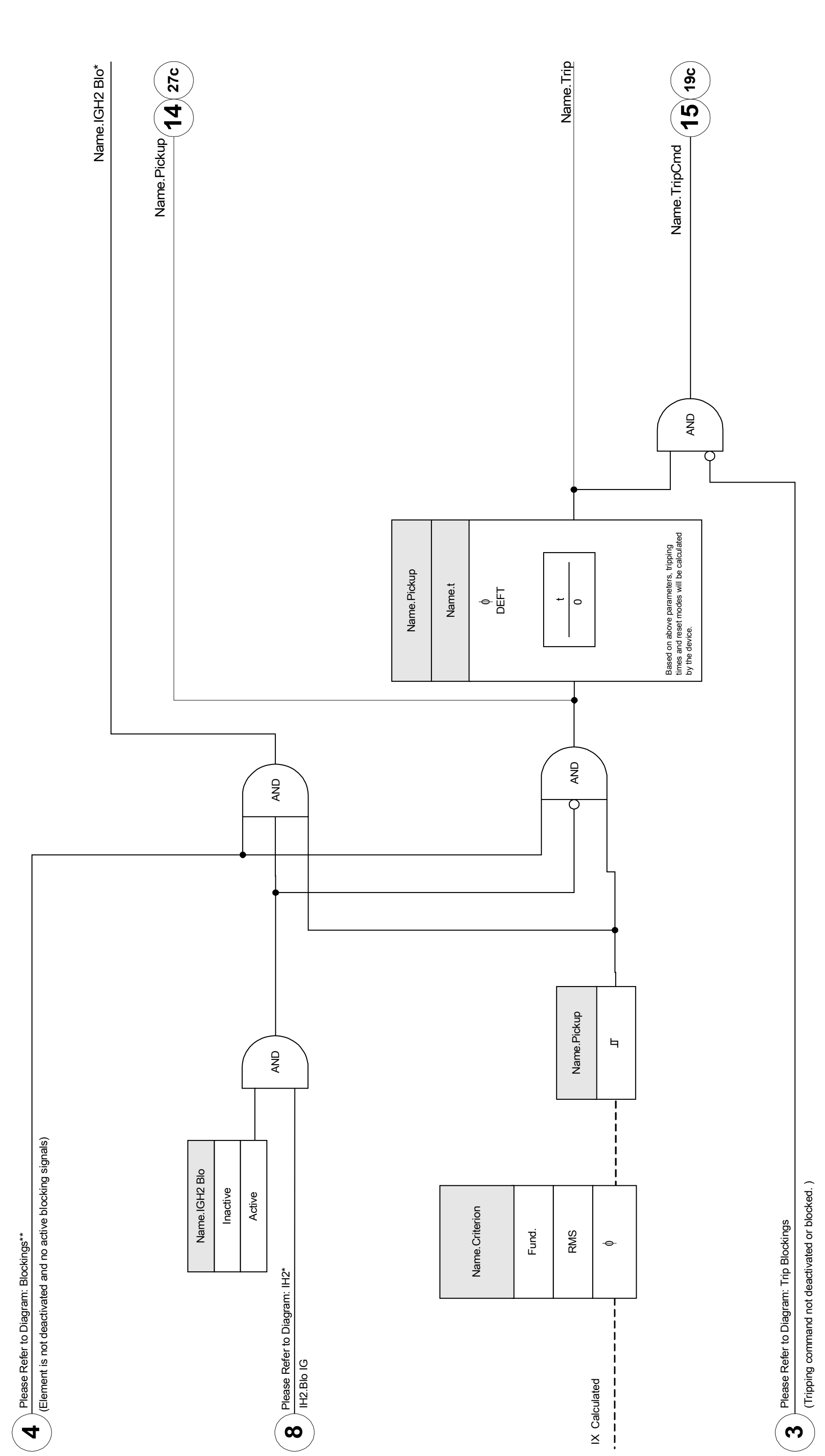
•DEFT (definite time).

For tripping curves please refer to the “Appendix/Instantaneous Current Curves (Ground Current Calculated)” section.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents. However, this is only possible if the current transformers are Wye-connected.

50R[1]...[n]

Name = 50R[1]...[n]



*=Applies only to devices that offer Inrush Protection

Device Planning Parameters of the 50R Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Non-directional	Non-directional	[Device Planning]

Global Protection Parameters of the 50R Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]

Parameter	Description	Setting Range	Default	Menu Path
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /50R[1]]

Setting Group Parameters of the 50R Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /I-Prot /50R[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /50R[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /50R[1]]
Pickup 	If the pickup value is exceeded, the module/element will be started. Only available if: Characteristic = DEFT Or Characteristic = INV	0.02 - 20.00In	50R[1]: 1In 50R[2]: 2In	[Protection Para /<n> /I-Prot /50R[1]]
t 	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	0.5s	[Protection Para /<n> /I-Prot /50R[1]]

50R Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /50R[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /50R[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /50R[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /50R[1]]

50R Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 50R]

Please test the non-directional ground overcurrent using the procedure for non-directional phase overcurrent protection.

51R INV Calculated Ground Fault Protection Module [ANSI 51R]

Elements
51R[1] ,51R[2]

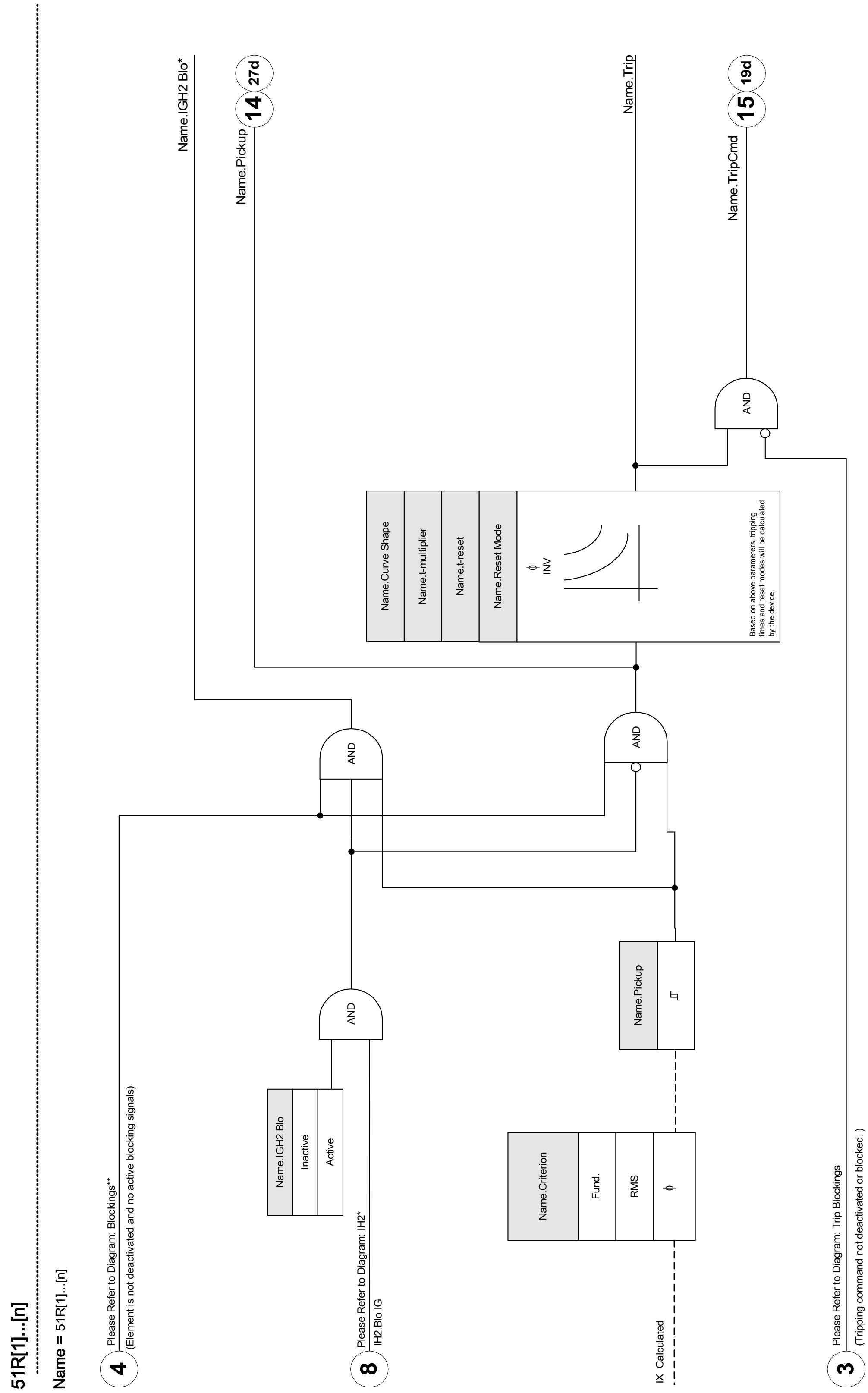
NOTICE **All ground current elements are identically structured.**

For each element the following characteristics are available:

•NINV (IEC/XInv);
•VINV (IEC/XInv);
•LINV (IEC/XInv);
•EINV (IEC/XInv);
•MINV (ANSI/XInv);
•VINV (ANSI/XInv);
•EINV (ANSI/XInv);
•Thermal Flat;
•Therm Flat IT;
•Therm Flat I2T; and
•Therm Flat I4T.

For tripping curves please refer to the “Appendix/Time Current Curves (Ground Current)” section.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents. However, this is only possible if the current transformers are Wye-connected.



*=Applies only to devices that offer Inrush Protection

Device Planning Parameters of the 51R Ground Fault Protection

Parameter	Description	Options	Default	Menu Path
Mode	Mode	51R[1]: Non-directional 51R[2]: Do not use, Non-directional	Non-directional	[Device Planning]

Global Protection Parameters of the 51R Ground Fault Protection

Parameter	Description	Setting Range	Default	Menu Path
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /51R[1]]

Setting Group Parameters of the 51R Ground Fault Protection

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Active	[Protection Para /<n> /I-Prot /51R[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /I-Prot /51R[1]]
Criterion	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /51R[1]]
Pickup	If the pickup value is exceeded, the module/element will be started.	0.02 - 20.00In	51R[1]: 0.1In 51R[2]: 0.5In	[Protection Para /<n> /I-Prot /51R[1]]
Curve Shape	Characteristic	IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	ANSI MINV	[Protection Para /<n> /I-Prot /51R[1]]
t-multiplier	Time multiplier/tripping characteristic factor	0.02 - 20.00	51R[1]: 1 51R[2]: 2	[Protection Para /<n> /I-Prot /51R[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Reset Mode	Reset Mode	Instantaneous, t-delay, Calculated	Calculated	[Protection Para /<n> /I-Prot /51R[1]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Only available if:Reset Mode = t-delay	0.00 - 60.00s	0.00s	[Protection Para /<n> /I-Prot /51R[1]]

51R Ground Fault Protection Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /I-Prot /51R[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /51R[1]]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet1-I	Module Input State: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet2-I	Module Input State: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet3-I	Module Input State: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /51R[1]]
AdaptSet4-I	Module Input State: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /51R[1]]

51R Ground Fault Protection Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup IX or IR
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Commissioning: Ground Fault Protection – Non-directional [ANSI 51R]

Please test the non-directional ground overcurrent analog to the non-directional phase overcurrent protection.

Zone Interlocking

Elements
ZI

Principle – General Use

The purpose of zone interlocking is to speed up tripping for some faults without sacrificing the coordination of the system and interjecting nuisance trips into the system. Zone interlocking devices can communicate across distribution zones to determine whether or not a device sees a fault condition.

Zone interlocking is a communication scheme used with breakers and protective relays to improve the level of protection in a power distribution system. This is achieved through communication between the downstream and upstream devices in a power system. The zones are classified by their location downstream of the main circuit protective device which is generally defined as Zone 1.

By definition, a selectively coordinated system is one where by adjusting the trip unit pickup and time delay settings, the breaker closest to the fault trips first. The upstream breaker serves two functions: (1) back-up protection to the downstream breaker and (2) protection of the conductors between the upstream and downstream breakers.

For faults which occur on the conductors between the upstream and downstream breakers, it is ideal for the upstream breaker to trip with no time delay. This is the feature provided by Zone Selective Interlocking.

The zone interlocking information can be transferred to or received from other compatible zone interlocking devices by means of suitable communication cables. The single zone interlock terminal block, with its 3-wire scheme, can be used for either phase zone interlocking, ground zone interlocking, or a combination of the two. If phase and ground zone interlocking are combined, the potential consequences must be understood before implementation.

WARNING **Systems containing multiple sources, or where the direction of power flow varies, require special considerations, or may not be suitable for this feature.**

NOTICE **The breaker failure pickup signal »BF.PICKUP« is implicitly connected to zone interlocking, so that NO zone interlock output signal can be sent to the upstream device if a breaker failure on a downstream device is detected.**

Description of the Functions and Features

- Configurable protection functions to initiate the zone interlocking OUTPUT signal (start functions).
- Remove zone interlocking OUTPUT signal immediately after detection of a breaker failure.
- Reset time (about ten cycles - settable) to interrupt OUTPUT signal for durable trip signal.
- Small trip delay (about three cycles – settable) to wait for downstream devices interlocking signals.
- Zone interlocking trip signal only possible by absence of zone interlocking INPUT signals.
- Configurable zone interlocking trip functions (protective functions serve as zone interlocking trip functions).

- Zone interlocking trip function pickup and tripping characteristic adaption using adaptive settings controlled by the zone interlocking input signals.

Device Planning Parameters of the Zone Interlocking

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Use	Use	[Device Planning]

Global Protection Parameters of the Zone Interlocking

In the global parameter menu for zone interlocking, two external blocking inputs (*»Ex Block1/Ex Block2«),* as with other protection modules, can be assigned to the input of the zone interlocking function so that the zone interlock function can be blocked by an assigned functions

Via an external input signal, the zone interlocking can also be blocked if the parameter *»ExtBlockTripCMD«* is assigned.

NOTICE **Breaker Failure Pickup flag BF.Pickup is implicitly connected to zone interlocking, so that NO zone interlock output signal can be sent to the upstream device if a breaker failure on downstream device is detected.**

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ZI]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ZI]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ZI]

Setting Group Parameters of the Zone Interlocking

The zone interlocking Setting Group Parameters consists of three groups of setting to configure the zone interlocking module to adapt to various application philosophies accordingly:

- General: This group comprises the settings used to control the general usage of the zone interlocking module.

- OUTPUT: What should be assigned to the Zone Out?
  - Phase,
  - Ground, or
- - Both.

  The OUTPUT group comprises the settings to configure the zone interlocking output logic. If the zone interlocking application is used to a downstream device, the settings in OUTPUT group should be programmed accordingly. If the zone interlocking application is only used for an upstream device (main breaker or Zone 1), the setting ZoneInterlockOut within the OUTPUT group should be disabled.

- TRIP: Activate the Zone Trip.

  The TRIP group comprises the settings used to configure the zone interlocking TRIP logic. If the zone interlocking application is applied to an upstream device, (main breaker or Zone 1), the settings in the TRIP group should be programmed accordingly. If the zone interlocking application is only used for a downstream device (feeder breaker or Zone 2), the setting ZoneInterlockTrip in TRIP group should be disabled.

Setting the above mentioned setting groups accordingly the zone interlocking module can be configured as:

- Downstream device application (using only OUTPUT logic);,

- Upstream device application (using only TRIP logic); or

- Midstream device application (using both OUTPUT and TRIP logics together).

The following menu and tables show the detailed information about the settings.

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ZI /General Settings]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ZI /General Settings]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ZI /General Settings]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ZI /General Settings]
ZI OUT Fc	Zone Interlocking Out activate (allow) / inactivate (disallow)	Inactive, Active	Active	[Protection Para /<n> /ZI /Zone Out]
Fault Type	Fault Type	Phase, Ground, Both	Both	[Protection Para /<n> /ZI /Zone Out]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trip	Signal: Zone Interlocking Trip	Inactive, Active	Active	[Protection Para /<n> /ZI /Zone Trip]
Fault Type	Fault Type	Phase, Ground, Both	Both	[Protection Para /<n> /ZI /Zone Trip]

Zone Interlocking Output Logic [X2]

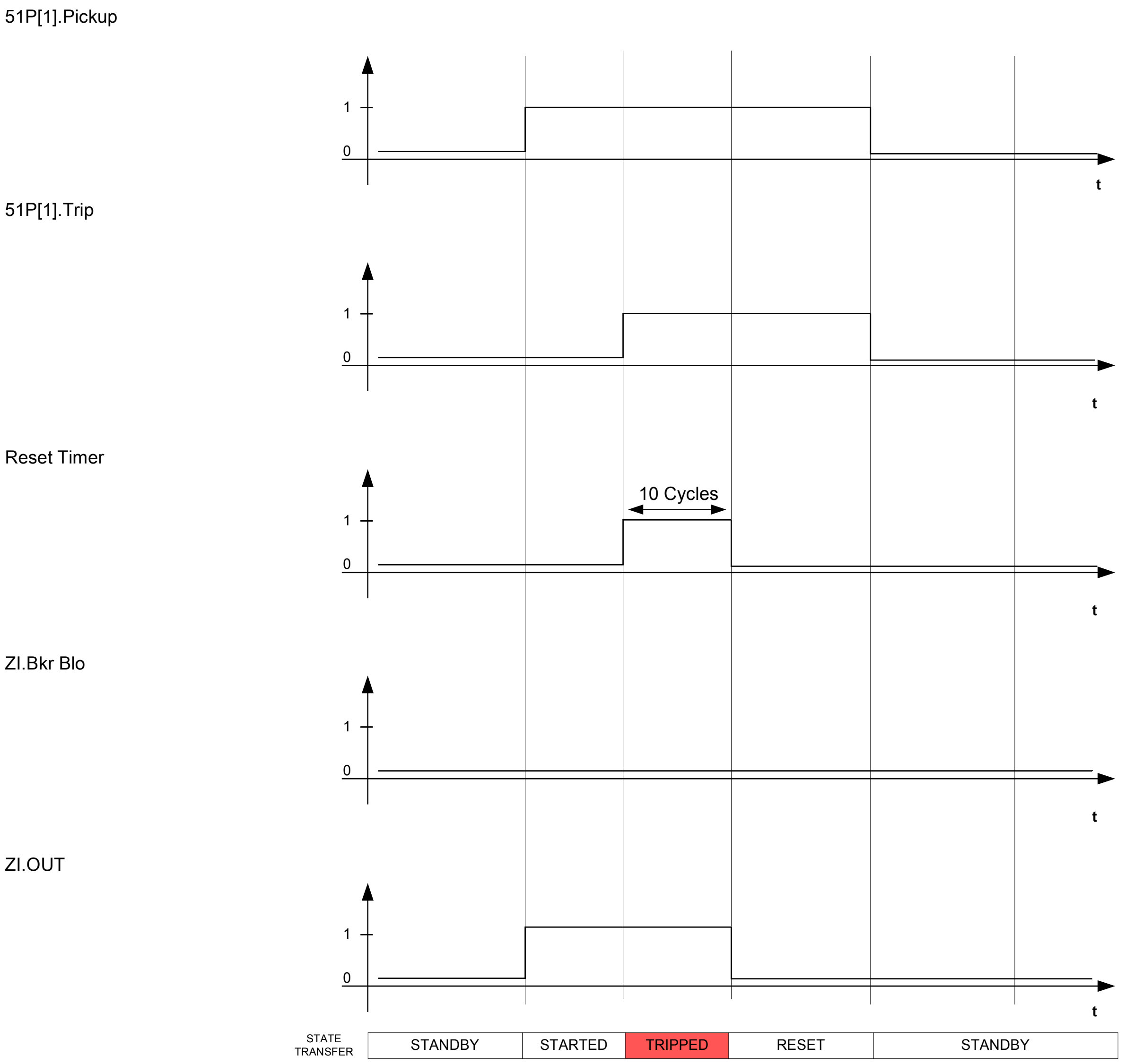
The following current protective function elements serve as the Phase Zone Interlock OUTPUT start functions:

- 51P[1];
- 50P[1]; and
- 50P[2].

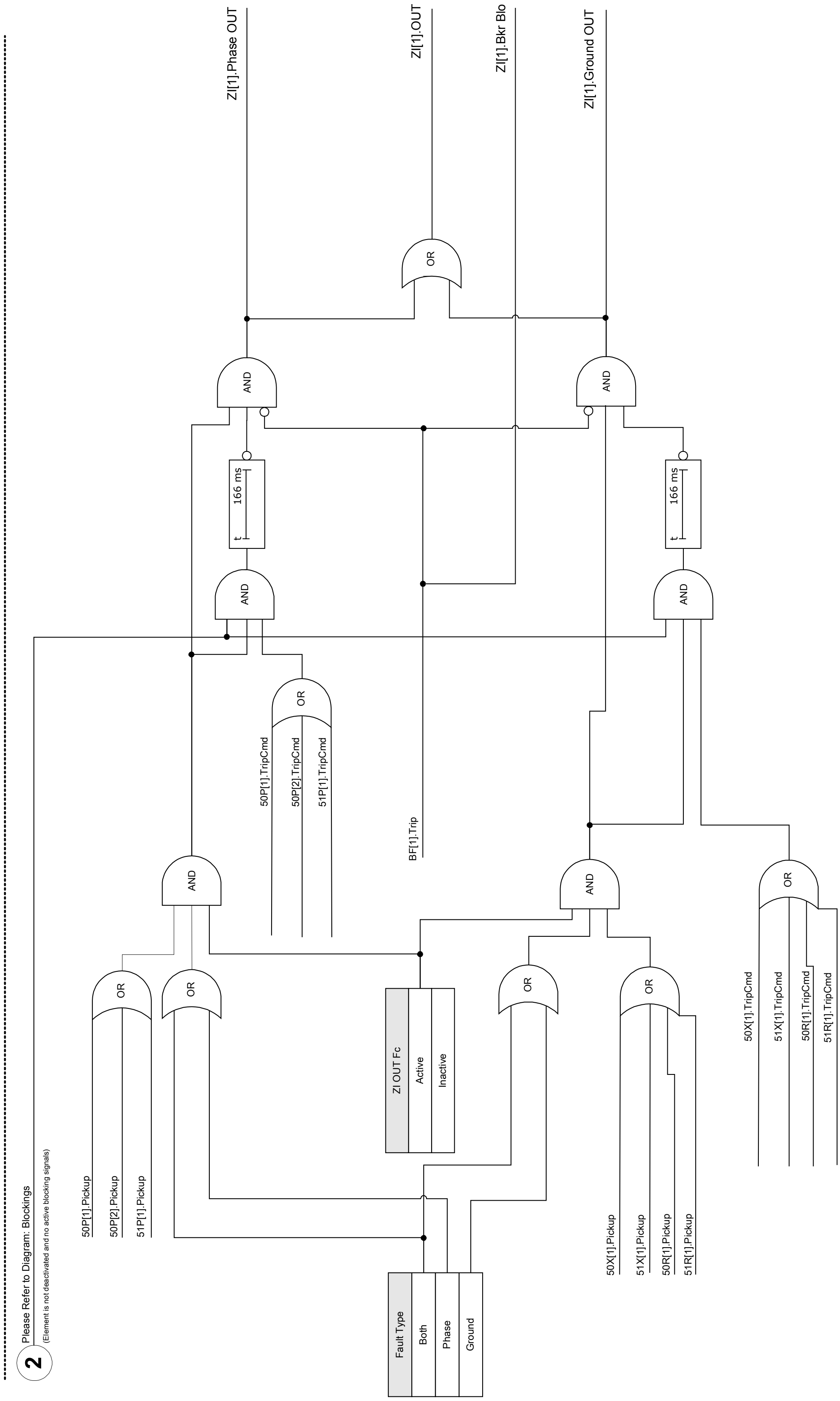
The following current protective function serves as the Ground Zone Interlock OUTPUT start functions:

- 51X[1];
- 50X[1];
- 51R[1]; and
- 50R[1].

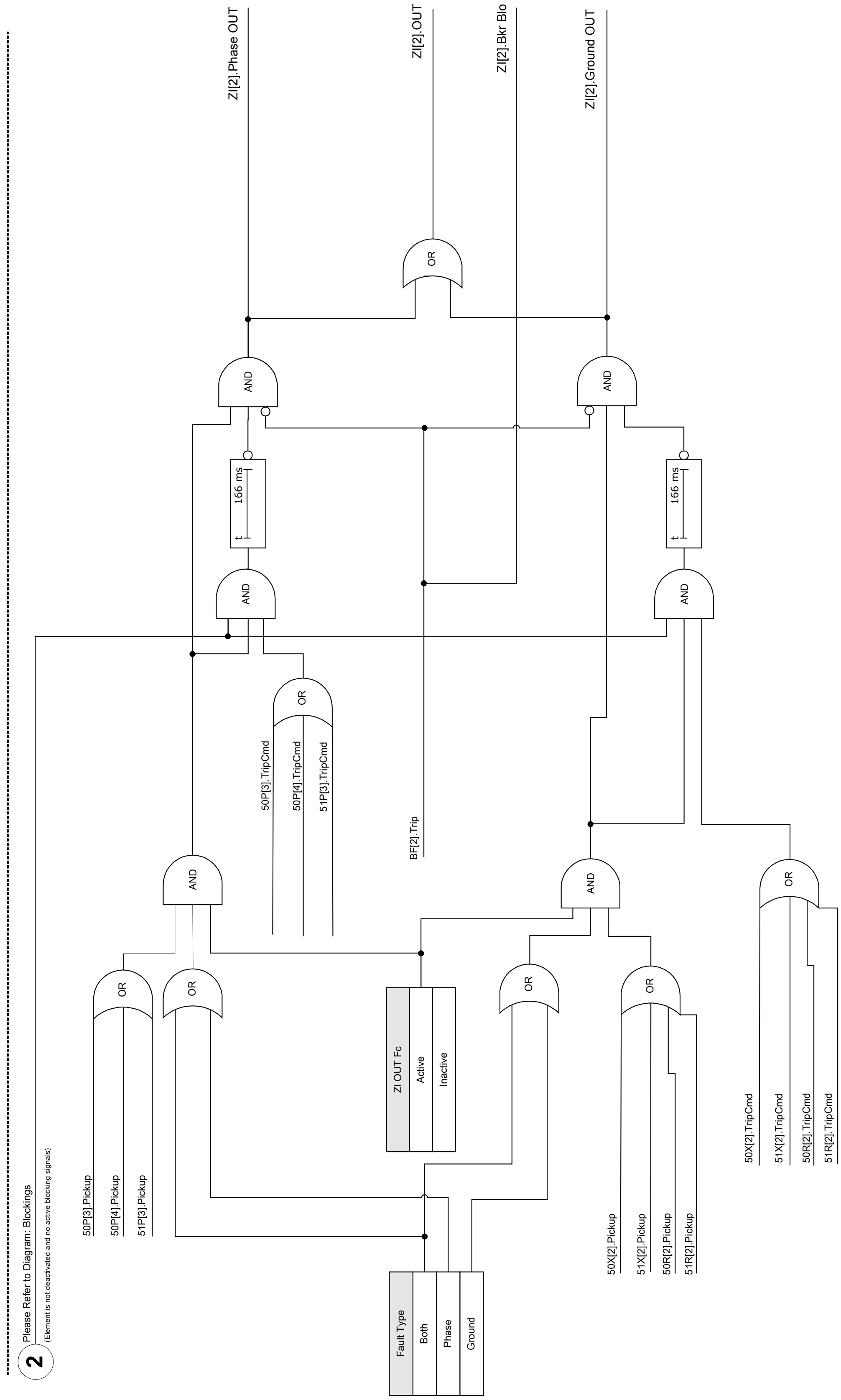
Zone Interlocking OUTPUT Logic Timing



X2: ZI.Zone Out



X5: ZI.Zone Out



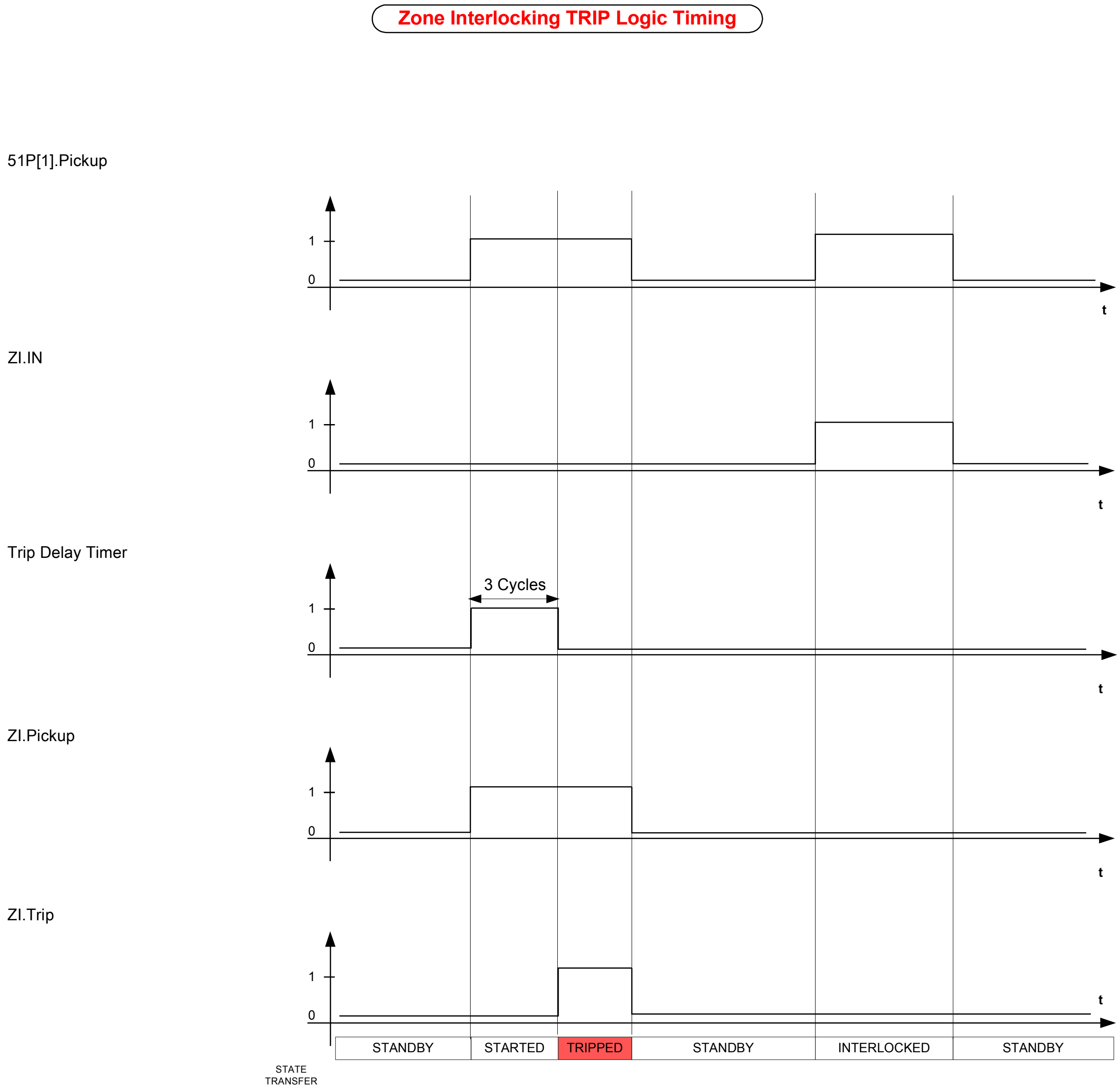
Zone Interlocking Trip Logic [X2]

The following overcurrent protection elements trigger Phase Zone-Interlock trip functions:

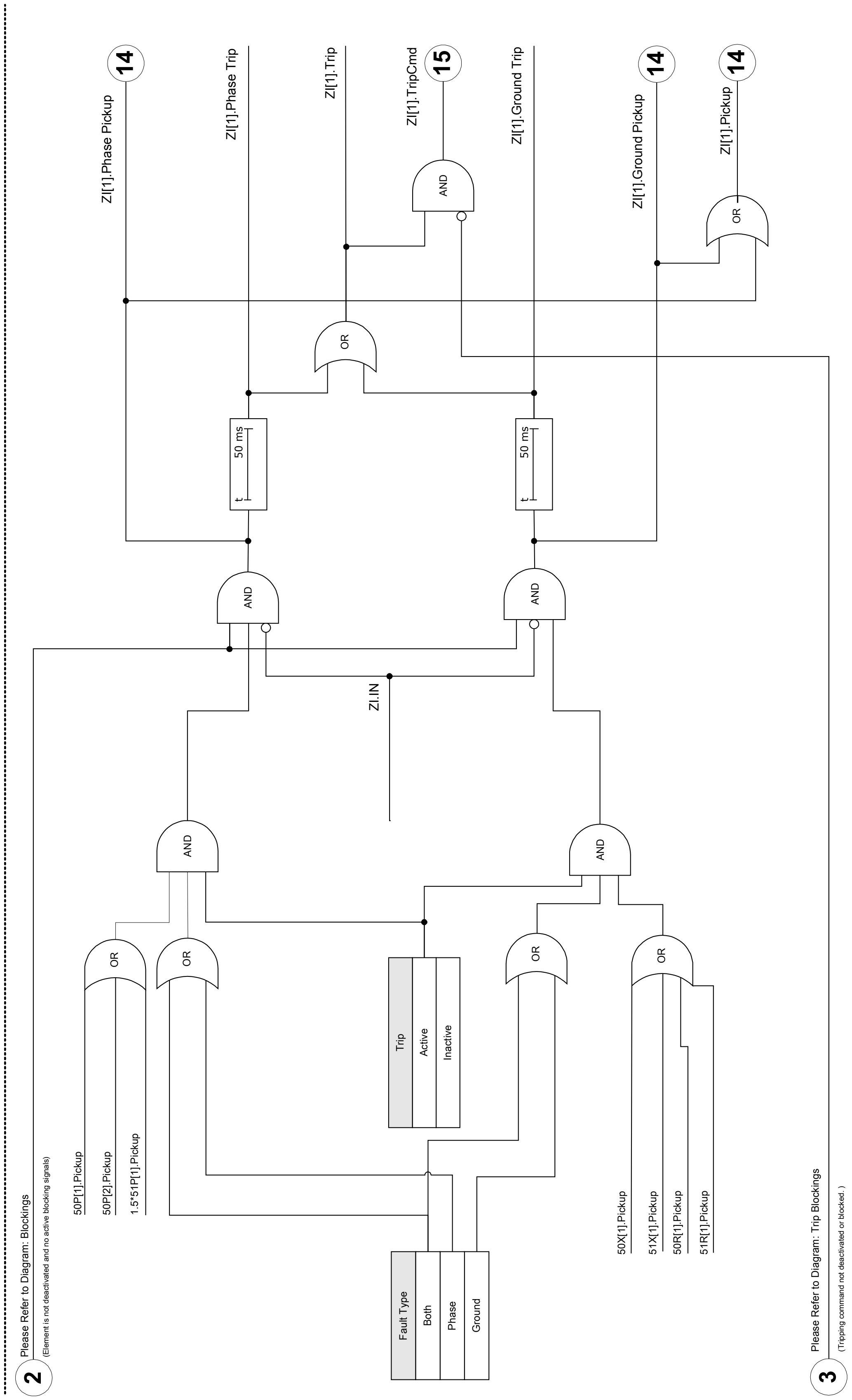
- 1.5 * 51P[1];
- 50P[1]; and
- 50P[2].

The following overcurrent protection elements trigger Ground Zone Interlock trip functions:

- 51X[1];
- 50X[1];
- 51R[1]; and
- 50R[1].



X2: ZI.Zone Trip



Zone Interlocking Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /ZI]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /ZI]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /ZI]
Bkr Blo-I	Signal: Blocked by Breaker Failure	[]

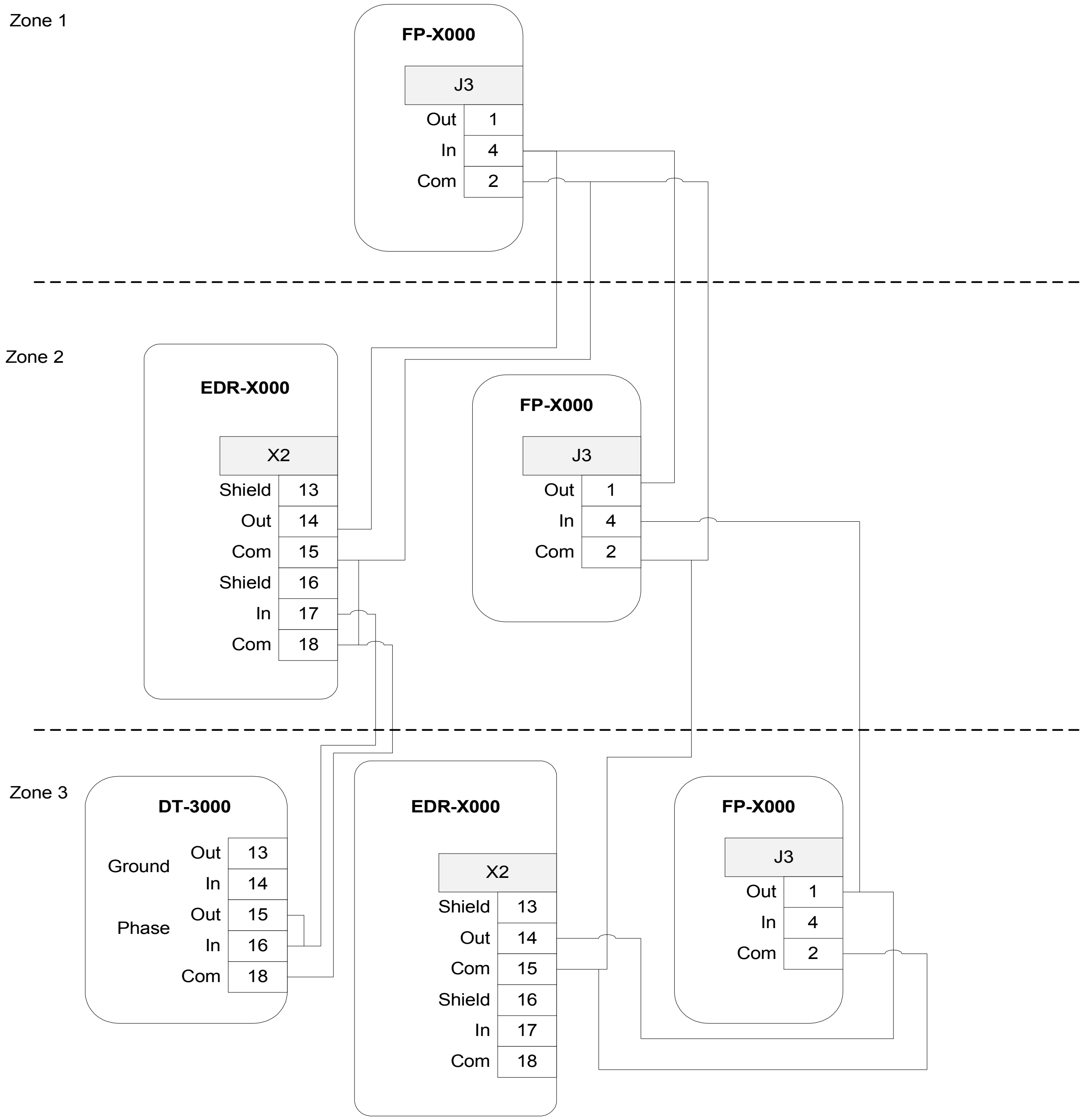
Zone Interlocking Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Bkr Blo	Signal: Blocked by Breaker Failure
Phase Pickup	Signal: Zone Interlocking Phase Pickup
Phase Trip	Signal: Zone Interlocking Phase Trip
Ground Pickup	Signal: Zone Interlocking Ground Pickup
Ground Trip	Signal: Zone Interlocking Ground Trip
Pickup	Signal: Pickup Zone Interlocking
Trip	Signal: Zone Interlocking Trip
TripCmd	Signal: Zone Interlocking Trip Command
Phase OUT	Signal: Zone Interlocking Phase OUT
Ground OUT	Signal: Zone Interlocking Ground OUT
OUT	Signal: Zone Interlocking OUT
IN	Signal: Zone Interlocking IN

Zone Interlocking Wiring

NOTICE **The ZI Outputs are for use with connection to electronic inputs only.**

The zone interlocking connection between relays is done by means of a twisted shielded cable. Downstream zone interlock outputs may be paralleled from up to ten devices (FP-5000 or DT-3000 or a combination of both) for connection to upstream zone interlocked relays.


Zone 1
FP-X000
J3
Out 1
In 4
Com 2
Zone 2
EDR-X000
X2
Shield 13
Out 14
Com 15
Shield 16
In 17
Com 18
FP-X000
J3
Out 1
In 4
Com 2
Zone 3
DT-3000
Ground
Out 13
In 14
Phase
Out 15
In 16
Com 18
EDR-X000
X2
Shield 13
Out 14
Com 15
Shield 16
In 17
Com 18
FP-X000
J3
Out 1
In 4
Com 2

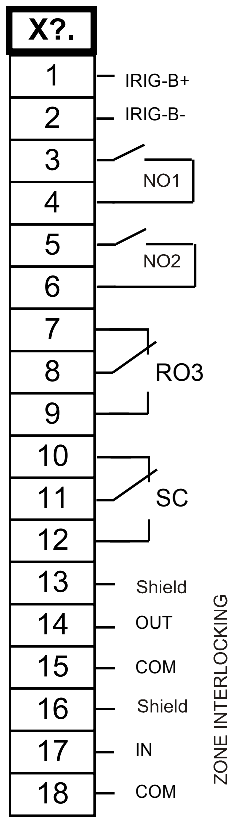
Hardware Terminals for Zone Interlocking

By means of the zone interlocking terminals, the device can be connected to other Eaton protective devices such as an FP5000, DT3000, etc.

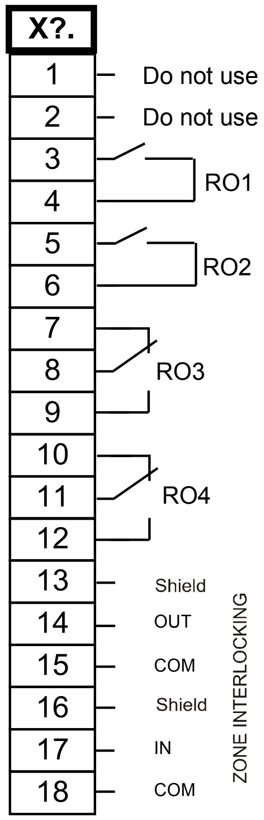
As an upstream device, the terminals - Phase/Ground IN should be connected to the OUT terminals of up to ten downstream device(s) by means of a dedicated cable wired in parallel. As a downstream device, the terminals - Phase/Ground OUT should be connected to the IN terminals of an upstream device by means of a dedicated cable.

The zone interlocking connection between relays is done by means of a twisted shielded cable. Downstream zone interlock outputs may be paralleled from up to ten devices (FP-5000 or DT-3000 or a combination of both) for connection.

Terminal Marking X2 *for Device: EDR-3000*



Terminal Marking X2 _for Device: EDR-4000_



46-Current Unbalance Protection Module

Elements:
46[1] ,46[2]

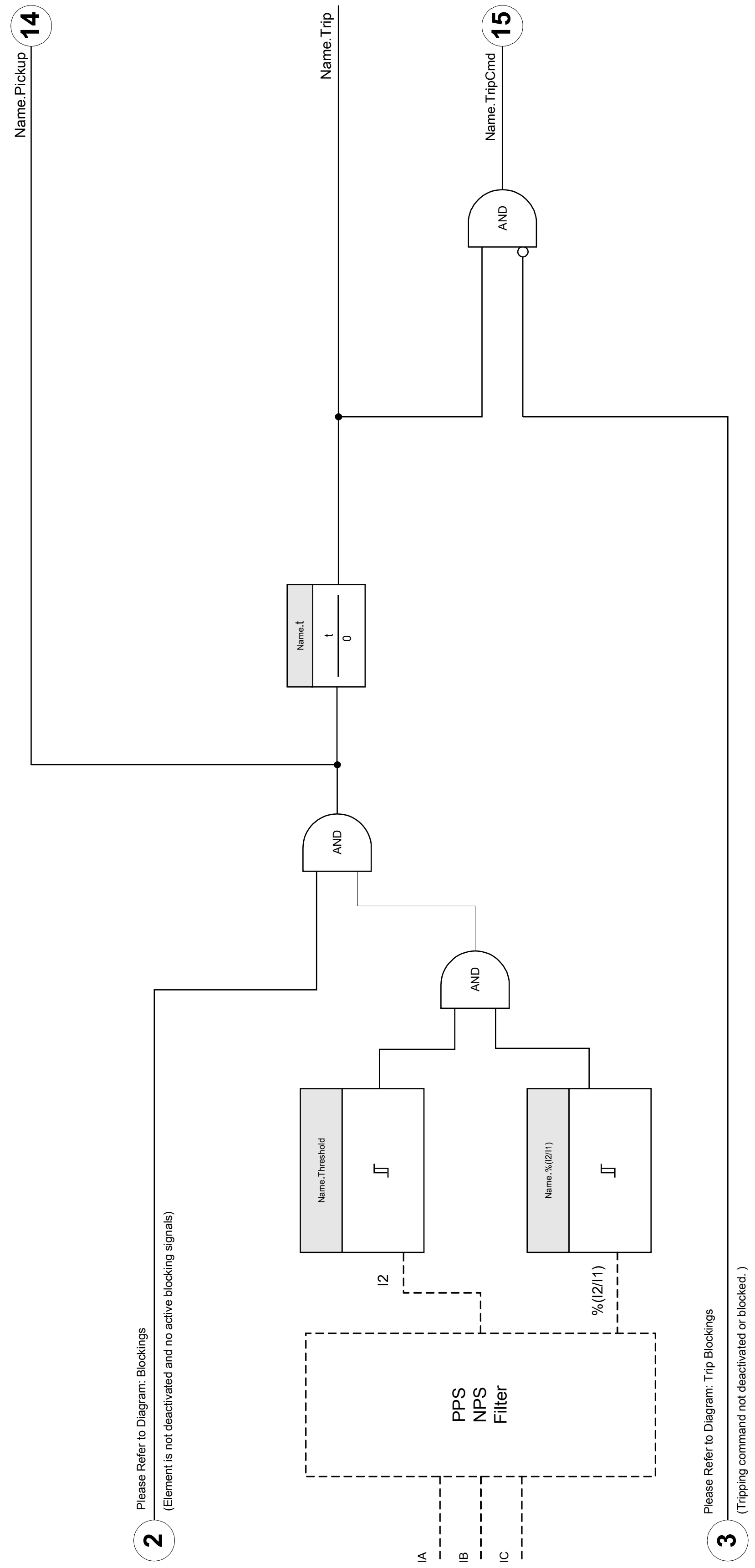
This is the *46* device Current Unbalance setting, which works similar to the *47* device Voltage Unbalance setting. The positive and negative sequence currents are calculated from the 3-phase currents. The Threshold setting defines a minimum operating current magnitude of either I1 or I2 for the 46 function to operate, which insures that the relay has a solid basis for initiating a current unbalance trip. The »*%(I2/I1)*« setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence current to positive sequence current »*%(I2/I1)*« for ABC rotation and »*%(I1/I2)*« for ACB rotation. The device will automatically select the correct ratio based on the Phase Sequence setting in the System Configuration group described above.

This function requires positive or negative sequence current magnitude above the threshold setting and the percentage current unbalance above the »*%(I2/I1)*« setting before allowing a current unbalance trip. Therefore, both the threshold and percent settings must be met for the specified Delay time setting before the relay initiates a trip for current unbalance.

NOTICE **All elements are identically structured.**

46[1]..[n]

Name = 46[1]...[n]



Device Planning Parameters of the Current Unbalance Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Current Unbalance Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Unbalance-Prot /46[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Unbalance-Prot /46[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Unbalance-Prot /46[1]]

Setting Group Parameters of the Current Unbalance Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /46[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /46[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /46[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /46[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Threshold	The Threshold setting defines a minimum operating current magnitude of either I1 or I2 for the 46 function to operate, which ensures that the relay has a solid basis for initiating a current unbalace trip. This is a supervisory function and not a trip level.	0.01 - 4.00In	0.1In	[Protection Para /<n> /Unbalance-Prot /46[1]]
%(I2/I1)	The %(I2/I1) setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence current to positive sequence current (% Unbalance=I2/I1), or %(I2/I1) for ABC rotation and %(I1/I2) for ACB rotation. Only available if: %(I2/I1) = Use	2 - 40%	46[1]: 40% 46[2]: 20%	[Protection Para /<n> /Unbalance-Prot /46[1]]
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	46[1]: 10s 46[2]: 20s	[Protection Para /<n> /Unbalance-Prot /46[1]]

Current Unbalance Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Unbalance-Prot /46[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Unbalance-Prot /46[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Unbalance-Prot /46[1]]

Current Unbalance Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup Negative Sequence
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Current Unbalance Module

Object to be tested:
Test of the unbalanced load protection function.

Necessary means:
- Three-phase current source with adjustable current unbalance; and
- Timer.

Procedure:

Check the phase sequence:

- Ensure that the phase sequence is the same as that set in the field parameters.
- Feed-in a three-phase nominal current.
- Change to the »Measuring Values« menu.
- Check the measuring value for the unbalanced current »*I2*«. The measuring value displayed for »*I2*« should be zero (within the physical measuring accuracy).

NOTICE **If the displayed magnitude for I2 is the same as that for the symmetrical nominal currents fed to the relay, it implies that the phase sequence of the currents seen by the relay is reversed.**

- Now turn-off phase A.
- Again check the measuring value of the unbalanced current »*I2*« in the »Measuring Values« menu. The measuring value of the asymmetrical current »*I2*« should now be 33%.
- Turn-on phase A, but turn-off phase B.
- Once again check the measuring value of the asymmetrical current I2 in the »Measuring Values« menu. The measuring value of the asymmetrical current »*I2*« should be again 33%.
- Turn-on phase B, but turn-off phase C.
- Again check the measuring value of asymmetrical current »*I2*« in the »Measuring Values« menu. The measuring value of the asymmetrical current »*I2*« should still be 33%.

Testing the trip delay:

- Apply a symmetrical three-phase current system (nominal currents).
- Switch off IA (the threshold value »*Threshold*« for »*I2*« must be below 33%).
- Measure the tripping time.

The present current unbalance »*I2*« corresponds with 1/3 of the existing phase current displayed.

Testing the threshold values

- Configure minimum »*%I2/I1*« setting (2%) and an arbitrary threshold value »*Threshold*« (I2).
- For testing the threshold value, a current has to be fed to phase A which is lower than three times the adjusted threshold value »*Threshold*« (I2).
- Feeding only phase A results in »*%I2/I1 = 100%*«, so the first condition »*%I2/I1 >= 2%*« is always fulfilled.
- Now increase the phase A current until the relay is activated.

Testing the dropout ratio of the threshold values

Having tripped the relay in the previous test, now decrease the phase A current. The dropout ratio must not be higher than 0.97 times the threshold value.

Testing %I2/I1

- Configure minimum threshold value »*Threshold*« (I2) (0.01 x In) and set »*%I2/I1*« greater or equal to 10%.
- Apply a symmetrical three-phase current system (nominal currents). The measuring value of »*%I2/I1*« should be 0%.
- Now increase the phase A current. With this configuration, the threshold value »*Threshold*« (I2) should be reached before the value »*%I2/I1*« reaches the set »*%I2/I1*« ratio threshold.
- Continue increasing the phase 1 current until the relay is activated.

Testing the dropout ratio of %I2/I1

Having tripped the relay in the previous test, now decrease the phase A current. The dropout of »*%I2/I1*« has to be 1% below the »*%I2/I1*«setting.

Successful test result:

The measured trip delays, threshold values, and dropout ratios are within the permitted deviations/tolerances, specified under Technical Data.

Breaker Wear

BWear

Principle – General Use

The sum of the accumulated interrupted currents are monitored by the Breaker Wear Module.

Device Planning Parameters of the Breaker Wear Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Breaker Wear Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Bkr Manager /BWear]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Bkr Manager /BWear]
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Bkr Manager /BWear]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /Global Prot Para /Bkr Manager /BWear]
Operations Alarm	Service Alarm, too many Operations	1 - 65535	100	[Protection Para /Global Prot Para /Bkr Manager /BWear]
Isum Intr Alarm	Alarm, the Sum (Limit) of interrupting currents has been exceeded.	0 - 2500000A	70000A	[Protection Para /Global Prot Para /Bkr Manager /BWear]

Breaker Wear Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Bkr Manager /BWear]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Bkr Manager /BWear]

Breaker Wear Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Operations Alarm	Signal: Service Alarm, too many Operations
Isum Intr trip: IA	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IA
Isum Intr trip: IB	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IB
Isum Intr trip: IC	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IC
Isum Intr trip	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded in at least one phase.
Res TripCmdCr	Signal: Resetting of the Counter: total number of trip commands
Res Isum trip	Signal: Reset summation of the tripping currents

Breaker Wear Counter Values

Value	*Description*	*Menu Path*
TripCmd Cr	Counter: Total number of trips of the switchgear (breaker, load break switch…).	[Operation /Count and RevData /BWear]

Breaker Wear Values

Value	*Description*	*Default*	*Size*	*Menu Path*
Isum trip IA	Summation of the tripping currents phase1	0A	0 - 65535A	[Operation /Count and RevData /BWear]
Isum trip IB	Summation of the tripping currents phase2	0A	0 - 65535A	[Operation /Count and RevData /BWear]
Isum trip IC	Summation of the tripping currents phase3	0A	0 - 65535A	[Operation /Count and RevData /BWear]

Direct Commands of the Breaker Wear Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Res TripCmdCr	Resetting of the Counter: total number of trip commands	Inactive, Active	Inactive	[Operation /Reset]
Res Isum trip	Reset summation of the tripping currents	Inactive, Active	Inactive	[Operation /Reset]

LOP – Loss of Potential

Available elements:
LOP

LOP function detects the loss of voltage in any of the voltage input measuring circuits and uses the following measured values and information to detect an LOP condition:

•Three-phase voltages;

•Ratio of negative-to-positive sequence voltages;

•Zero sequence voltage;

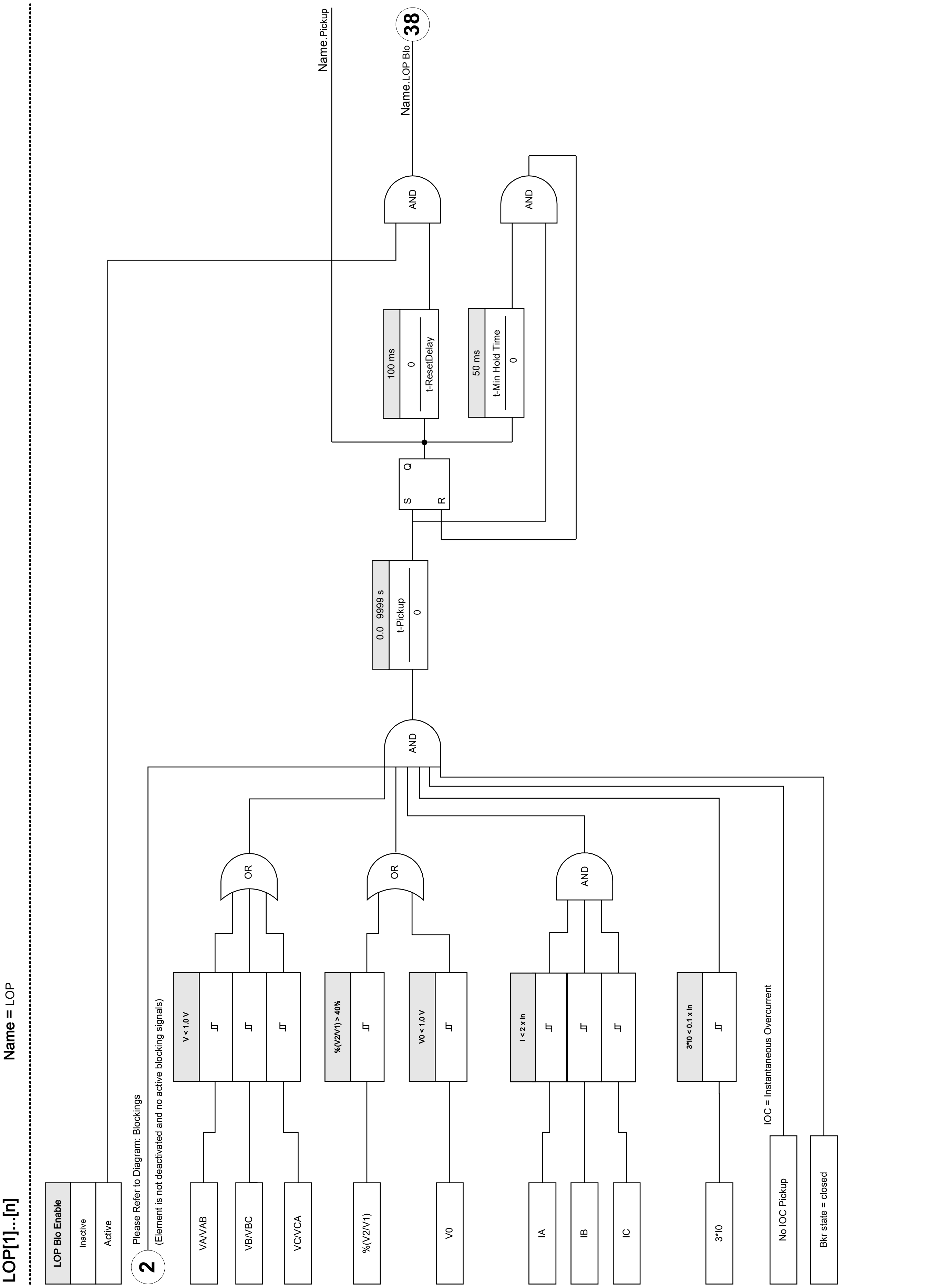
•Three-phase currents;

•Residual current (I0);

•Pickup flags from all overcurrent elements; and

•Breaker status

Once an LOP condition is detected and it lasts longer than an adjustable minimum pickup time, the LOP Pickup will be set. The LOP Block will only be set if the LOP-Block control setting is set to enabled (activated). The LOP Pickup and LOP Block signals can both be used as logical signal to block the protective functions which use the voltage information such as voltage restraint. The minimum pickup timer is used to prevent short time incorrect operation of the LOP function during breaker switching-on operation.


LOP[1]..[n]
Name = LOP
LOP Blo Enable
Inactive
Active
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
VA/VAB
VB/VBC
VC/VCA
V < 1.0 V
OR
%(V2/V1)
%(V2/V1) > 40%
V0
V0 < 1.0 V
OR
IA
IB
IC
I < 2 x In
AND
3*I0
3*I0 < 0.1 x In
IOC = Instantaneous Overcurrent
No IOC Pickup
Bkr state = closed
AND
0.0 9999 s
t-Pickup
0
S
R
Q
100 ms
0
t-ResetDelay
50 ms
t-Min Hold Time
0
AND
AND
Name.Pickup
Name.LOP Blo
38

Device Planning Parameters of the LOP Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Use	Use	[Device Planning]

Global Protection Parameters of the LOP Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /LOP]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /LOP]

Setting Group Parameters of the LOP Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /LOP]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /LOP]
LOP Blo Enable	Activate (allow) or inactivate (disallow) blocking by the module LOP.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /LOP]
UndervoltageThreshold	Criterion 1: Any of the phase voltages less than 1.0 V (hidden)	0.01 - 2.00Vn	0.01Vn	[Protection Para /<n> /Supervision /LOP]
OvercurrentThreshold	Criterion 4: None of the phase currents greater than 2xIn (hidden)	0.01 - 40.0In	2.0In	[Protection Para /<n> /Supervision /LOP]
ResidualCurrentThreshold	Criterion 5: Residual current less than 0.1xIn (hidden)	0.01 - 20.0In	0.1In	[Protection Para /<n> /Supervision /LOP]
ZeroVoltageThreshold	Criterion 7: Zero sequence Voltage (V0) less than 0.01xVn (hidden)	0.01 - 2.0Vn	0.01Vn	[Protection Para /<n> /Supervision /LOP]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
V2_2_V1	Criterion 6: Negative to positive phase sequence voltage (%) greater than 40% (hidden)	0 - 100%	40%	[Protection Para /<n> /Supervision /LOP]
t-Pickup	Pickup Delay	0 - 9999.0s	0.1s	[Protection Para /<n> /Supervision /LOP]
t-ResetDelay	Reset Delay	0 - 9999.0s	0.1s	[Protection Para /<n> /Supervision /LOP]
t-Min Hold Time	Minimum hold time after triggering the Loss of Potential Module.	0 - 9999.0s	0.05s	[Protection Para /<n> /Supervision /LOP]

LOP Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Supervision /LOP]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Supervision /LOP]
State	Module input state: Breaker Position (0 = Indeterminate, 1 = OPEN, 2 = CLOSE, 3 = Disturbed)	[]

LOP Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup	Signal: Pickup Loss of Potential
LOP Blo	Signal: Loss of Potential blocks other elements

Commissioning: Loss of Potential

Object to be tested:

Testing the *LOP*.

Necessary means:

- Three-phase current source and
- Three-phase voltage source.

Procedure part 1:

Examine if the output signals »LOP BLO « (200ms delay) and »LOP« only become true if:

•Any of the three-phase voltages becomes less 1 Volt
and
•The residual voltage is less than 1 Volt or the %V2/V1 ratio is greater 40%
and
•All three-phase currents are less than 2 * Ipu (rated current)
and
•The residual current is less than 0.1 Ipu (rated current)
and
•No pickup of an IOC element
and
•The breaker is closed.

Successful test result part 1:

The output signals only become true if all the above mentioned conditions are fulfilled.

Procedure part 2:

Assign the »LOP« or »LOP BLO« output signals to all protection element that should be blocked by *LOP* (e.g.: Undervoltage Protection, Voltage Restraint...).

Test if those elements are blocked if the LOP modules issue a blocking signal.

Successful test result part 2:

All elements that should be blocked in case of LOP are blocked if the conditions (Procedure part 1) are fulfilled.

SOTF - Protection Module: Switch Onto Fault

SOTF

In case a faulty line is energized (e.g.: when an earthing switch is in the ON position), an instantaneous trip is required. The SOTF module is provided to generate a permissive signal for other protection functions such as overcurrents to accelerate their trips. The SOTF condition is recognized according to the User's operation mode that can be based on:

•The breaker state;

•No current flowing;

•Breaker state and no current flowing;

•Breaker switched on manually; and/or

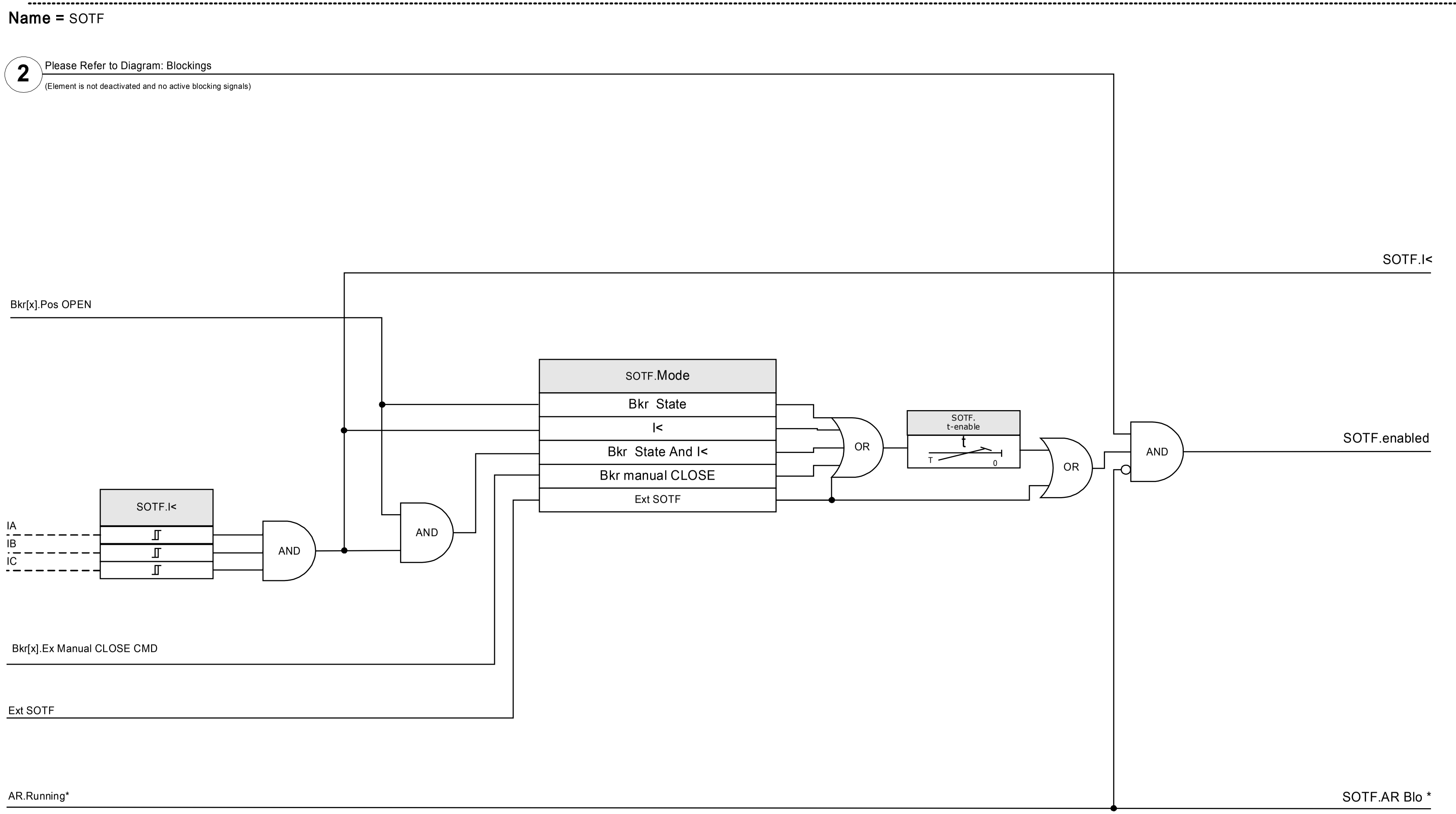
•An external trigger.

This protection module can initiate a high speed trip of the overcurrent protection modules. The module can be started via a digital input that indicates that the breaker is manually closed.

CAUTION **This module issues a signal only (the module is not armed and does not issue a trip command).**

In order to influence the trip settings of the overcurrent protection in case of switching onto a fault, the User has to assign the signal "SOTF.ENABLED" to an Adaptive Parameter Set. Please refer to Parameter / Adaptive Parameter Sets sections. Within the Adaptive Parameter Set, the User has to modify the trip characteristic of the overcurrent protection according to the User's needs.

SOTF



*Applies only for devices with Auto Reclosure

Device Planning Parameters of the Switch Onto Fault Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Switch Onto Fault Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Mode	Mode	Bkr State, I<, Bkr State And I<, Bkr manual CLOSE, Ext SOTF	Bkr manual CLOSE	[Protection Para /Global Prot Para /SOTF]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /SOTF]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /SOTF]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /SOTF]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ex Manual CLOSE CMD	External manual breaker CLOSE command (NOT for AR!). The breaker was closed manually if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Switch Onto Fault (SOTF), e.g. as a trigger signal. Only available if: Mode = Bkr manual CLOSE	-.-, Bkr.Ex Manual CLOSE CMD	-.-	[Protection Para /Global Prot Para /SOTF]
Ext SOTF	External Switch Onto Fault Only available if: Mode = Ext SOTF	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	-.-	[Protection Para /Global Prot Para /SOTF]

Setting Group Parameters of the Switch Onto Fault Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /SOTF]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /SOTF]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /SOTF]
I<	The breaker is in the OPEN Position, if the measured current is less than this parameter.	0.01 - 1.00In	0.01In	[Protection Para /<n> /SOTF]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-enable	While this timer is running, and while the module is not blocked, the Switch Onto Fault Module is effective (SOTF is armed).	0.10 - 10.00s	2s	[Protection Para /<n> /SOTF]

Switch Onto Fault Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /SOTF]
ExBlo2-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /SOTF]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /SOTF]
Ex Manual CLOSE CMD-I	Module Input State: External manual breaker CLOSE command (NOT for AR!)	[Protection Para /Global Prot Para /SOTF]
Bkr Pos Detect-I	Module Input State: Criterion by which the Breaker Switch Position is to be detected.	[]
Ext SOTF-I	Module Input State: External Switch Onto Fault Alarm	[Protection Para /Global Prot Para /SOTF]

Signals of the Switch Onto Fault Module (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
I<	Signal: No Load Current.

Commissioning: Switch Onto Fault [ANSI 50HS]

Object to be tested:

Testing the module *Switch Onto Fault* according to the configured operating mode:

•I< (No current);

•Bkr state (Breaker position);

•I< (No current) and Bkr state (Breaker position); and

•Bkr manual ON.

Necessary means:

•Three-phase current source (if the Enable Mode depends on current);

•Ampere meters (may be needed if the Enable Mode depends on current); and

•Timer.

Test Example for Mode Bkr Manual ON

NOTICE

Mode I< (In order to test the effectiveness): Initially, do not feed any current. Start the timer and feed with an abruptly changing current that is distinctly greater than the I<-threshold to the measuring inputs of the relay.

Mode I< and Bkr state: Simultaneously, manually switch on the breaker and feed with an abrupt change current that is distinctly greater than the I<-threshold.

Mode Bkr state: The breaker has to be in the OFF position. The signal „SOTF.ENABLED“=0 is false. If the breaker is switched on, the signal „SOTF.ENABLED“=1 becomes true as long as the timer t-effective is running.

•The breaker has to be in the OFF position. There must be no load current.

•The status display of the device shows the signal "SOTF.ENABLED“=1.

Testing:

•Manually switch the breaker to the ON position and start the timer at the same time.

•After the hold time t-enable is expired, the state of the signal has to change to "SOTF.enabled“=0.

•Write down the measured time.

Successful test result:

The measured total tripping delays or individual tripping delays, threshold values, and drop-out ratios correspond with those values, specified in the adjustment list. Permissible deviations/tolerances can be found in the Technical Data section.

CLPU - Supervision Module Cold Load Pickup

Available Elements:
CLPU

When manually or automatically closing a breaker after it has been open for a prolonged time, a greater than normal load current may be experienced due to the load inrush . This high starting current causes some overcurrent elements to unnecessarily trip the breaker. The cold load pickup (CLPU) function prevents this from happening.

The cold load pickup function detects a warm-to-cold load transition according to the four selectable cold load detection modes:

•Breaker state;
•Undercurrent (I<);
•Breaker state AND undercurrent; and
•Breaker state OR undercurrent.

After a warm-to-cold load transition has been detected, a specified load-off timer will be started. This User-settable load-off timer is used in some cases to make sure that the load is really “cold” enough. After the load-off timer times out, the CLPU function issues an “enable” signal »CLPU.ENABLED« that can be used to block User-selected, sensitive protection elements such as instantaneous overcurrent elements, current unbalance, or power protection elements. Using this enable signal, some User-selected time inverse overcurrent elements may also be desensitized by means of activating adaptive settings of the corresponding overcurrent elements.

When a cold load condition is finished (a cold-to-warm load condition is detected) due to, for example, breaker closing or load current injection, a load inrush detector will be initiated that supervises the coming and going of the load inrush current process. A load inrush is detected if the coming load current exceeds a User-specified inrush current threshold. This load inrush is considered as finished if the load current is decreased to 90% of the inrush current threshold.

After the inrush current is diminished, a settle timer starts. The cold load pickup enable signal can only be reset after the settle timer times out. Another max-Block timer, which is started parallel with the load inrush detector after a cold load condition is finished, may also terminate the CLPU enable signal if a load inrush condition is prolonged abnormally.

The cold load pickup function can be blocked manually by external or internal signal at the User´s choice. For the devices with the Auto-Reclosing function, the *CLPU* function will be blocked automatically if auto-reclosure is initiated (AR is running).

CAUTION

This module issues a signal only (it is not armed).

In order to influence the tripping settings of the overcurrent protection, the User has to assign the signal “CLPU.ENABLED“ to an adaptive parameter set. Please refer to the Parameter / Adaptive Parameter Sets section. Within the adaptive parameter set, the User has to modify the tripping characteristic of the overcurrent protection according to the needs.

NOTICE

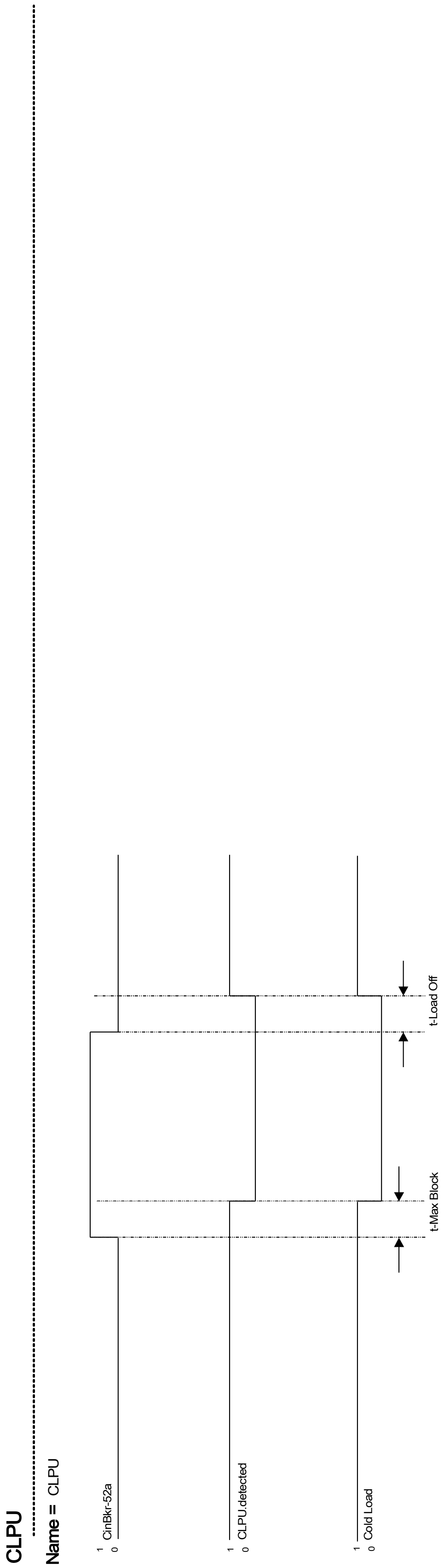
Please be aware of the meaning of the two delay timers.

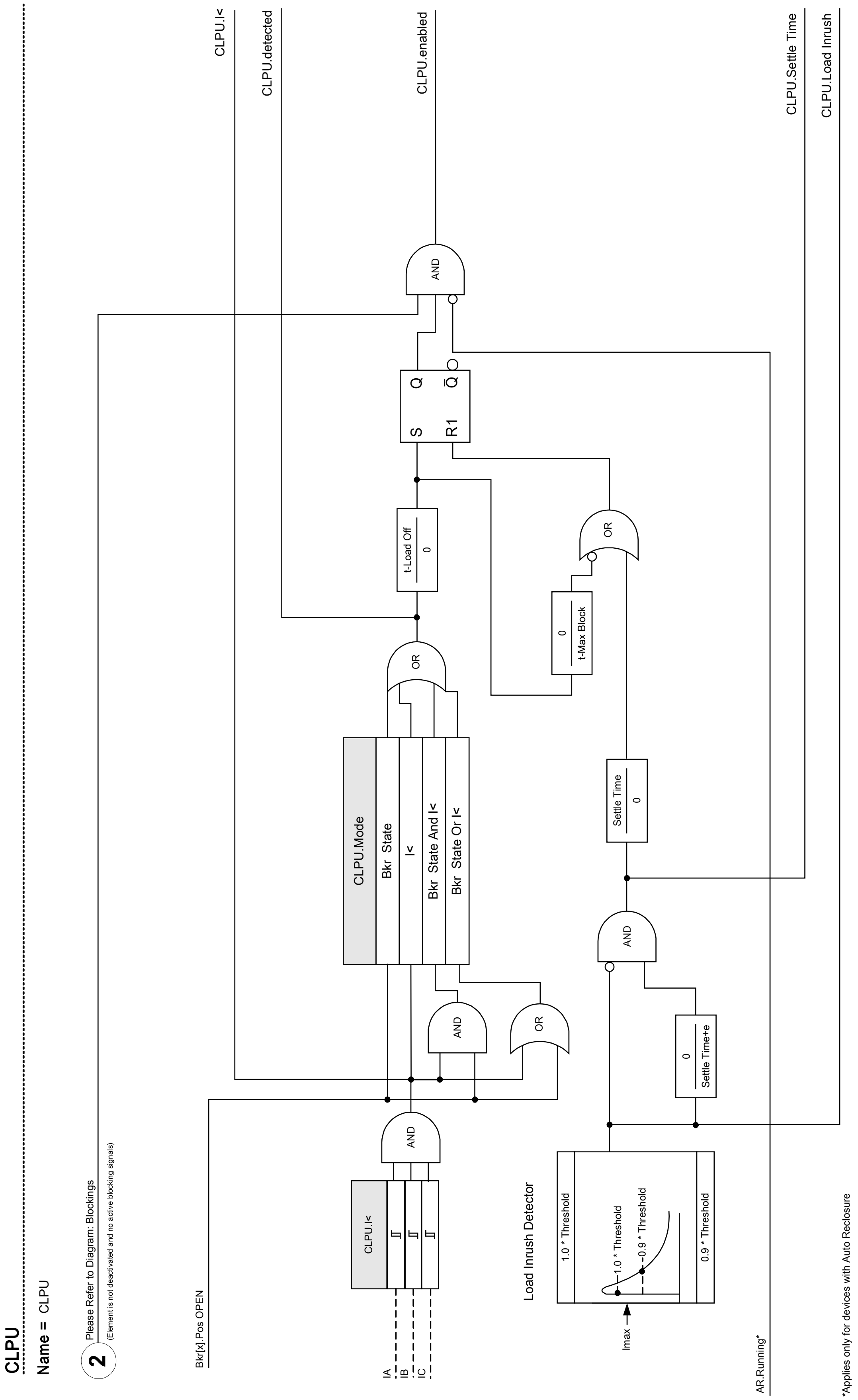
t load Off (Pickup Delay): After this time expires, the load is no longer diversified.

t Max Block (Release Delay): After the starting condition is fulfilled (e.g.: breaker switched on manually), the “CLPU.enabled” signal will be issued for this time. That means for the duration of this time, the tripping thresholds of the overcurrent protection can be desensitized by means of adaptive parameters (please refer to the Parameters section). This timer

will be stopped if the current falls below 0.9 times of the threshold of the load inrush detector and remains below 0.9 times of the threshold for the duration of the settle time.

Example Mode: Breaker Position




CLPU
Name = CLPU
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
Bkr[x].Pos OPEN
IA
IB
IC
CLPU.I<
AND
OR
CLPU.Mode
Bkr State
I<
Bkr State And I<
Bkr State Or I<
t-Load Off
0
S
R1
Q
CLPU.I<
CLPU.detected
CLPU.enabled
t-Max Block
Settle Time
Settle Time+e
Load Inrush Detector
1.0 * Threshold
0.9 * Threshold
Imax
AR.Running*
CLPU.Settle Time
CLPU.Load Inrush
*Applies only for devices with Auto Reclosure

Device Planning Parameters of the Cold Load Pickup Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameter of the Cold Load Pickup Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Mode	Mode	Bkr State, I<, Bkr State Or I<, Bkr State And I<	Bkr State	[Protection Para /Global Prot Para /CLPU]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /CLPU]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /CLPU]
Rvs Blo	Reverse Blocking, if Reverse Blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /CLPU]

Set Parameters of the Cold Load Pickup Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /CLPU]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /CLPU]
Rvs Blo Fc	Activate (allow) or inactivate (disallow) reverse blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/element are blocked that are parameterized "Rvs Blo Fc = active".	Inactive, Active	Inactive	[Protection Para /<n> /CLPU]
t-Load Off	Select the outage time required for a load to be considered cold. If the Pickup Timer (Delay) has run out, a Cold Load Signal will be issued.	0.00 - 7200.00s	10s	[Protection Para /<n> /CLPU]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t-Max Block	Select the maximum amount of time allowed for cold load pickup to be active; if the time has elapsed a warm load signal will be issued.	0.00 - 300.00s	10s	[Protection Para /<n> /CLPU]
I<	The breaker is in the OPEN Position, if the measured current is less than this parameter.	0.01 - 1.00In	0.01In	[Protection Para /<n> /CLPU]
Threshold	Set the load current inrush threshold.	0.10 - 4.00In	1.2In	[Protection Para /<n> /CLPU]
Settle Time	Select the time for the cold load inrush.	0.00 - 300.00s	1.00s	[Protection Para /<n> /CLPU]

States of the Inputs of the Cold Load Pickup Module

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /CLPU]
ExBlo2-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /CLPU]
Rvs Blo-I	Module Input State: Reverse Blocking	[Protection Para /Global Prot Para /CLPU]
Bkr Pos Detect-I	Module Input State: Criterion by which the Breaker Switch Position is to be detected.	[]

Signals of the Cold Load Pickup Module (States of the Outputs)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Rvs Blo	Signal: Reverse Blocking
enabled	Signal: Cold Load enabled
detected	Signal: Cold Load detected
I<	Signal: No Load Current.
Load Inrush	Signal: Load Inrush
Settle Time	Signal: Settle Time

Commissioning of the Cold Load Pickup Module

Object to be tested:

Testing the *Cold Load Pickup* module according to the configured operating mode:

•I< (No current);
•Bkr state (Breaker position);
•I< (No Current) and Bkr state (Breaker position); and
•I< (No Current) or Bkr state (Breaker position).

Necessary means:

•Three-phase current source (if the Enable Mode depends on current);
•Ampere meters (may be needed if the Enable Mode depends on current); and
•Timer.

Test Example for Mode Bkr State (Breaker Position)

NOTICE

Mode I<: In order to test the tripping delay, start the timer then feed with an abruptly changing current that is distinctly less than the I<-threshold. Measure the tripping delay. In order to measure the drop-out ratio, feed an abruptly changing current that is distinctly above the I<-threshold.

Mode I< and Bkr state: Combine the abruptly changing current(switching the current ON and OFF) with the manual switching ON and OFF of the breaker.

Mode I< or Bkr state: Initially carry out the test with an abruptly changing current that is switched ON and OFF (above and below the I<-threshold). Measure the tripping times. Finally, carry out the test by manually switching the breaker ON and OFF.

•The breaker has to be in the OFF position. There must not be any load current.

•The Status Display of the device shows the signal "CLPU.ENABLED“=1.

•The Status Display of the device shows the signal ”CLPU.I<“=1.

Testing the tripping delay and the resetting ratio:

•Manually switch the breaker ON and simultaneously start the timer.

•After the the »*t Max Block (Release Delay)*« timer has expired, the signal "CPLU.Enabled “=0 has to be false.

•Write down the measured time.

•Manually switch the breaker OFF and simultaneously start the timer.

•After the »*t load Off*« timer has expired, the signal ”CPLU.ENABLED “=1 has to become true.

•Write down the measured time.

Successful test result:

The measured total tripping delays or individual tripping delays, threshold values, and drop-out ratios correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found in the Technical Data section.

27M - Undervoltage Protection Module

Available elements:
27M[1] ,27M[2]

NOTICE

M is for "Main" referring to protection metered by the Main Voltage transformer in the System Configuration.

All undervoltage elements are identically structured.

NOTICE

Definition of Vn: Vn is dependent on the System Parameter setting of "Main VT con".

In case that within the System Parameters "Main VT con" is set to "Open-Delta":

$$Vn = Main\,VT\,sec \quad .$$

In case that "Main VT con" is set to "Wye":

$$Vn = \frac{Main\,VT\,sec}{\sqrt{3}}$$

This is the 27 device undervoltage setting for the main three phase VT. This function consists of a Phase, a Pickup, a Delay setting. The Phase setting allows the User to select at which phase (any one, any two, or all) the undervoltage function operates. The Pickup setting is the magnitude at which the undervoltage element operates. The Delay setting is the time period an undervoltage must occur before the device initiates a trip. Depending on the settings within the System Parameters, the element works based on phase-to-phase (»*Open-Delta*«) or phase-to-ground (»*wye*«) voltages. This element will operate depending on the phase setting: if any one, any two, or all of the voltage(s) that is/are selected by the Phase setting drop(s) below the set point. This element works based on RMS values.

An undervoltage pickup occurs when the measured voltage drops below the UV Threshold setting. The undervoltage trip is set when the voltage stays below the threshold setting for the delay time specified (within the number of phases specified by the phase setting). The undervoltage pickup and trip is reset when the voltage rises above the dropout ratio specified in Specifications section for the undervoltage protection.

If the element should be blocked in the event of a "Loss of Potential", the »LOP Blo« parameter must be set to »*active*«.

CAUTION

If the VT measurement location is not at the bus bar side but at the output side, the following has to be taken into account.

When disconnecting the line, it has to be ensured by an *»External Blocking«* that undervoltage tripping cannot happen. In order to block the 27M element in case that the breaker is open:

- **Assign the *»Bkr.POS OPEN«* signal to a blocking input (»ExBlo1« or »ExBlo2« within the Global Parameters) of the *27M* element,**

  and

- **»ExBlo Fc« has to be set to "active" within the parameter sets of the the *27M* element.**

When the auxiliary voltage is switched on and the measuring voltage has not yet been applied, undervoltage tripping has to be prevented by an *»External Blocking«*. Otherwise a continuous tripping would occur, disabling the ability to energize again.

NOTICE

If phase voltages are applied to the measuring inputs of the device and field parameter *»VT con«* is set to *»Phase-to-ground«*, the messages issued by the voltage protection module in case of actuation or trip should be interpreted as follows:

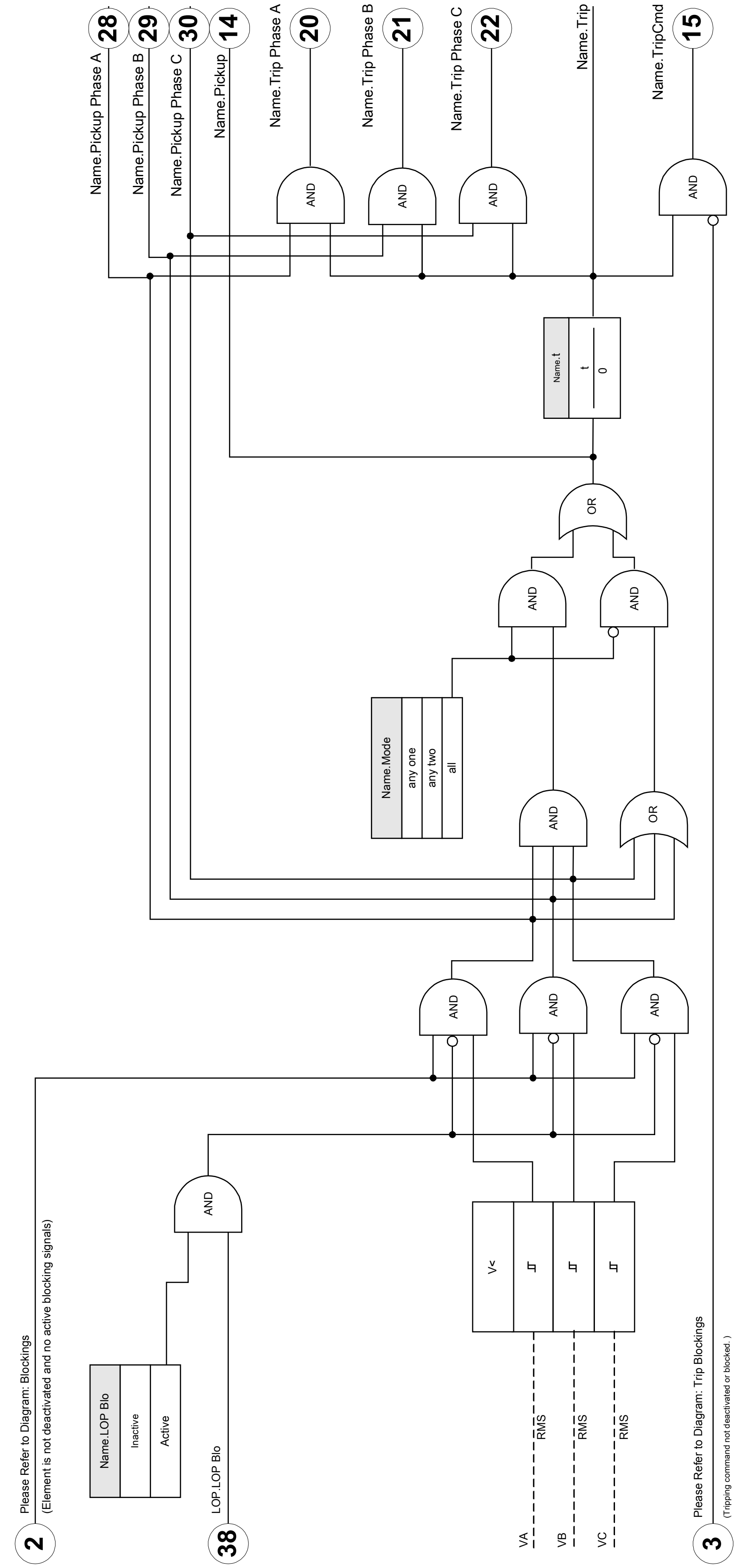
»27M[1].Pickup A« or »27M[1].Trip A« => pickup or trip caused by phase voltage *»VA«*.
»27M[1].Pickup B« or »27M[1].Trip B« => pickup or trip caused by phase voltage *»VB«*.
»27M[1].PickupB« or »27M[1].Trip B« => pickup or trip caused by phase voltage *»VC«*.

However, if line-to-line voltages are applied to the measuring inputs and field parameter *»VT con«* is set to *»Phase to Phase«*, then the messages should be interpreted as follows:

»27M[1].Pickup A« or »27M[1].Trip A« => pickup or trip caused by phase-to-phase voltage *»VAB«*.
»27M[1]. Pickup B« or »27M[1].Trip B« => pickup or trip caused by phase-to-phase voltage *»VBC«*.
»27M[1]. Pickup C« or »27M[1].Trip C« => pickup or trip caused by phase-to-phase voltage *»VCA«*

27M[1]...[n]

Name = 27M[1]...[n]



Device Planning Parameters of the Undervoltage Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Undervoltage Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Main-V-Prot /27M[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Main-V-Prot /27M[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Main-V-Prot /27M[1]]

Setting Group Parameters of the Undervoltage Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /27M[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /27M[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /27M[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /27M[1]]
Phases	Indicates if one, two of three or all phases are required for operation	any one, any two, all	any one	[Protection Para /<n> /Main-V-Prot /27M[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Pickup	If the pickup value is exceeded, the module/element will be started. Definition of Vn: Vn is dependent on the System Parameter setting of "Main VT con". In case that within the System Parameters "Main VT con" is set to "Open-Delta" , "Vn = Main VT sec ". In case that "Main VT con" is set to "Wye", "Vn = Main VT sec/SQRT(3)". Only available if: Device Planning: V.Mode = V<	0.01 - 2.00Vn	27M[1]: 0.80Vn 27M[2]: 0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t	Tripping delay	0.00 - 300.00s	27M[1]: 10s 27M[2]: 2.00s	[Protection Para /<n> /Main-V-Prot /27M[1]]
LOP Blo	Blocking if voltage transformer failure detected. LOP (Loss of Potential)	Inactive, Active	Active	[Protection Para /<n> /Main-V-Prot /27M[1]]
Vstart<	If the voltage falls below this voltage, the Time Depending Voltage Protection will be started. Only available if: Device Planning: V.Mode = Vstart<	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<1	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.01Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t1	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	0.00s	[Protection Para /<n> /Main-V-Prot /27M[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
V(t)<2	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.01Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t2	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	0.15s	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<3	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.70Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t3	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	0.15s	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<4	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.70Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t4	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	0.70s	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<5	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t5	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	1.50s	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<6	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t6	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /27M[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
V(t)<7	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t7	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<8	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t8	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<9	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t9	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /27M[1]]
V(t)<10	Pickup value Only available if: Device Planning: V.Mode = V(t)<	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /27M[1]]
t10	Tripping delay Only available if: Device Planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /27M[1]]

Undervoltage Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Main-V-Prot /27M[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Main-V-Prot /27M[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Main-V-Prot /27M[1]]

Undervoltage Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup Phase A	Signal: Pickup Phase A
Pickup Phase B	Signal: Pickup Phase B
Pickup Phase C	Signal: Pickup Phase C
Pickup	Signal: Pickup Voltage Element
Trip Phase A	Signal: General Trip Phase A
Trip Phase B	Signal: General Trip Phase B
Trip Phase C	Signal: General Trip Phase C
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Undervoltage Protection [27M]

This test can be carried out similar to the test for overvoltage protection 59M (by using the related undervoltage values).

Please consider the following deviations:

- For testing the threshold values, the test voltage has to be decreased until the relay is activated.
- For detection of the dropout ratio, the measuring quantity has to be increased to achieve more than 103% of the trip value. At 103% of the trip value, the relay is to dropout at the earliest moment.

59M - Overvoltage Protection Module

Available elements:
59M[1] ,59M[2]

NOTICE

M is for "Main" referring to protection metered by the Main Voltage transformer in the System Configuration.

All elements are identically structured.

NOTICE

Definition of Vn: Vn is dependent on the System Parameter setting of "Main VT con".

In case that within the System Parameters "Main VT con" is set to "Open-Delta":

$$Vn = Main\,VT\,sec\quad.$$

In case that "Main VT con" is set to "Wye":

$$Vn = \frac{Main\,VT\,sec}{\sqrt{3}}$$

This is the 59 device Overvoltage setting for the Main VT. This element consists of a Phase, a Pickup, and a Delay setting. The Phase setting allows the User to select which phase (any one, any two, or all) the Overvoltage function operates. Depending on the settings within the System Parameters, the element works based on phase-to-phase (»*Open-Delta*«) or phase-to-ground (»*wye*«) voltages. This element will operate depending on the phase setting: if any one, any two, or all of the voltage(s) that is/are selected by the Phase setting rise(s) above the set point. This element works based on RMS values.

An overvoltage pickup occurs when the measured voltage rises above the overvoltage Threshold setting. The overvoltage trip is set when the voltage stays above the threshold setting for the delay time specified (within the number of phases specified by the phase setting).. The overvoltage pickup and trip is reset when the voltage falls below the dropout ratio specified in Specifications section for the overvoltage protection.

NOTICE

If phase voltages are applied to the measuring inputs of the device and field parameter *»VT con«* is set to *»Phase-to-ground«*, the messages issued by the voltage protection module in case of actuation or trip should be interpreted as follows:

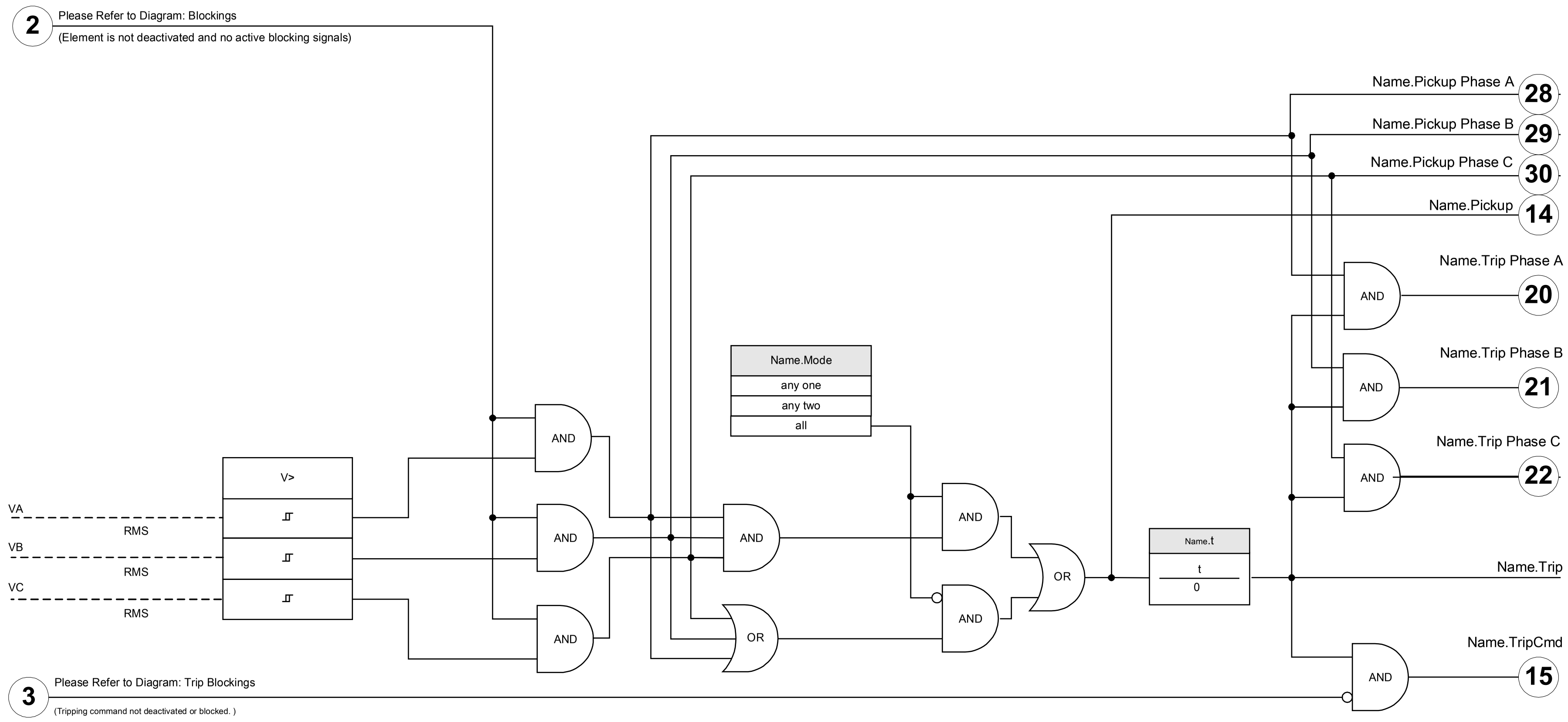
»59M[1].Pickup A« or »59M[1].Trip A« => pickup or trip caused by phase voltage *»VA«*.
»59M[1].Pickup B« or »59M[1].Trip B« => pickup or trip caused by phase voltage *»VB«*.
»59M[1].PickupB« or »59M[1].Trip B« => pickup or trip caused by phase voltage *»VC«*.

However,if line-to-line voltages are applied to the measuring inputs and field parameter *»VT con«* is set to *»Phase to Phase«*, then the messages should be interpreted as follows:

»59M[1].Pickup A« or »59M[1].Trip A« => pickup or trip caused by line-to-line voltage *»VAB«*.
»59M[1]. Pickup B« or »59M[1].Trip B« => pickup or trip caused by line-to-line voltage *»VBC«*.
»59M[1]. Pickup C« or »59M[1].Trip C« => pickup or trip caused by line-to-line voltage *»VCA«*

59M[1]...[n]

Name = 59M[1]...[n]



Device Planning Parameters of the Overvoltage Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Overvoltage Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Main-V-Prot /59M[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Main-V-Prot /59M[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Main-V-Prot /59M[1]]

Setting Group Parameters of the Overvoltage Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /59M[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /59M[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /59M[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Main-V-Prot /59M[1]]
Phases	Indicates if one, two of three or all phases are required for operation	any one, any two, all	any one	[Protection Para /<n> /Main-V-Prot /59M[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Pickup	If the pickup value is exceeded, the module/element will be started. Definition of Vn: Vn is dependent on the System Parameter setting of "Main VT con". In case that within the System Parameters "Main VT con" is set to "Open-Delta" , "Vn = Main VT sec ". In case that "Main VT con" is set to "Wye", "Vn = Main VT sec/SQRT(3)". Only available if: Device Planning: V.Mode = V>	0.01 - 2.00Vn	59M[1]: 1.2Vn 59M[2]: 1.1Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t	Tripping delay Only available if: Device Planning: V.Mode = V> Or V<	0.00 - 300.00s	59M[1]: 10s 59M[2]: 2.00s	[Protection Para /<n> /Main-V-Prot /59M[1]]
Vstart<	If the voltage falls below this voltage, the Time Depending Voltage Protection will be started.	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<1	Pickup value	0.01 - 2.00Vn	0.01Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t1	Tripping delay	0.00 - 10.00s	0.00s	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<2	Pickup value	0.01 - 2.00Vn	0.01Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t2	Tripping delay	0.00 - 10.00s	0.15s	[Protection Para /<n> /Main-V-Prot /59M[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
V(t)<3	Pickup value	0.01 - 2.00Vn	0.70Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t3	Tripping delay	0.00 - 10.00s	0.15s	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<4	Pickup value	0.01 - 2.00Vn	0.70Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t4	Tripping delay	0.00 - 10.00s	0.70s	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<5	Pickup value	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t5	Tripping delay	0.00 - 10.00s	1.50s	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<6	Pickup value	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t6	Tripping delay	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<7	Pickup value	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t7	Tripping delay	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /59M[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
V(t)<8	Pickup value	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t8	Tripping delay	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<9	Pickup value	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t9	Tripping delay	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /59M[1]]
V(t)<10	Pickup value	0.01 - 2.00Vn	0.90Vn	[Protection Para /<n> /Main-V-Prot /59M[1]]
t10	Tripping delay	0.00 - 10.00s	3.00s	[Protection Para /<n> /Main-V-Prot /59M[1]]

Overvoltage Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Main-V-Prot /59M[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Main-V-Prot /59M[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Main-V-Prot /59M[1]]

Overvoltage Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup Phase A	Signal: Pickup Phase A
Pickup Phase B	Signal: Pickup Phase B
Pickup Phase C	Signal: Pickup Phase C
Pickup	Signal: Pickup Voltage Element
Trip Phase A	Signal: General Trip Phase A
Trip Phase B	Signal: General Trip Phase B
Trip Phase C	Signal: General Trip Phase C
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Overvoltage Protection [59M]

Object to be tested:
Test of the overvoltage protection elements, 3 x single-phase and 1 x three-phase (for each element).

Necessary means:
- Three phase AC voltage source;
- Timer for measuring of the tripping time; and
- Voltmeter.

Procedure (3 x single-phase, 1 x three-phase, for each element)

Testing the threshold values:
For testing the threshold values and dropout values, the test voltage has to be increased until the relay is activated. When comparing the displayed values with those of the voltmeter, the deviation must be within the permissible tolerances.

Testing the trip delay:
For testing the trip delay, a timer is to be connected to the contact of the associated trip relay. The timer is started when the limiting value of the tripping voltage is exceeded and it is stopped when the relay trips.

Testing the dropout ratio:
Reduce the measuring quantity to less than 97% of the trip value. The relay must only dropout at a minimum of 97% of the trip value.

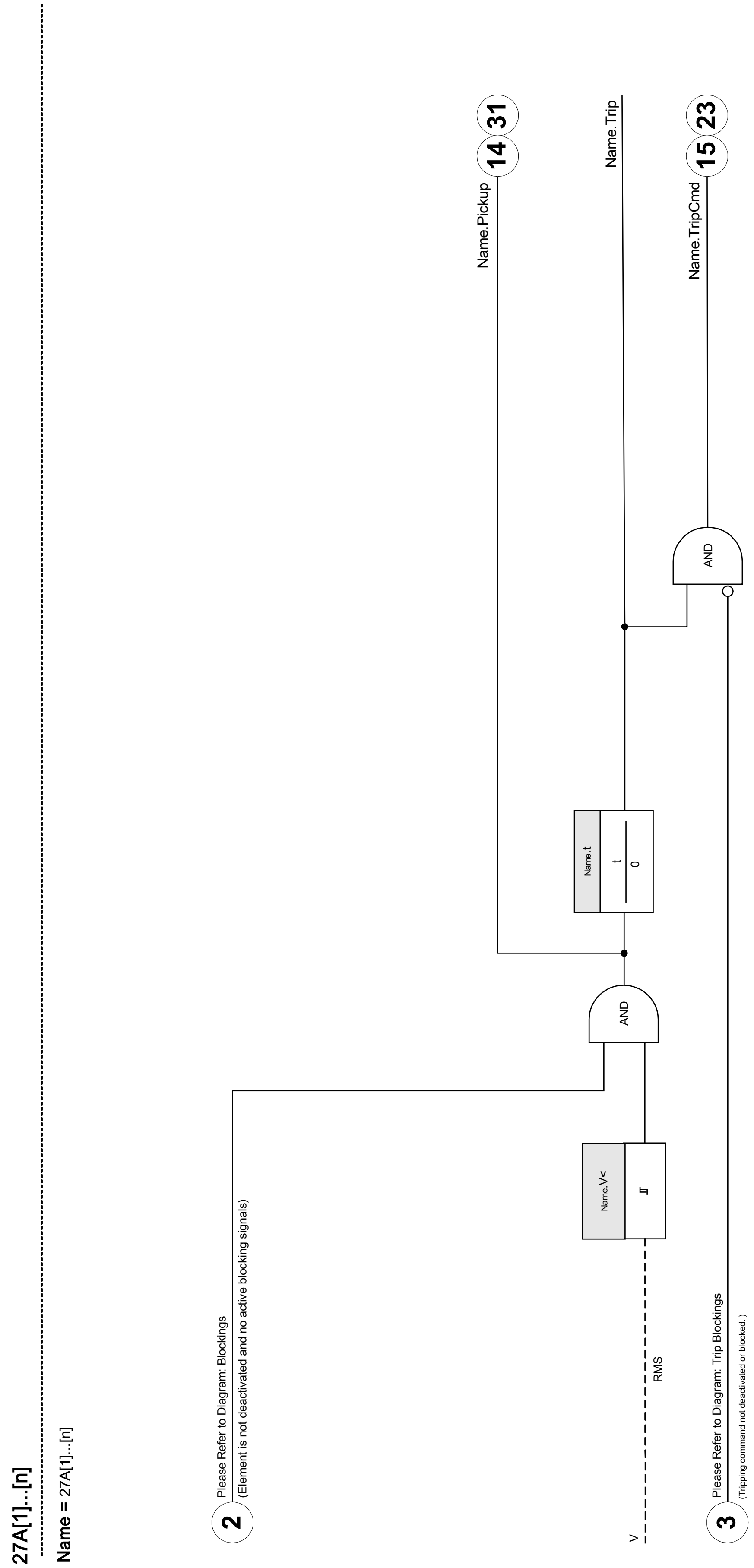
Successful test result:
The measured threshold values, trip delays, and dropout ratios comply with those specified in the adjustment list. Permissible deviations/tolerances can be taken from the Technical Data.

27A - Auxiliary Undervoltage Protection Module

Available elements:
27A[1] ,27A[2]

NOTICE **All elements are identically structured.**

This is the 27A device Undervoltage setting for the Auxiliary VT. This device setting works exactly the same as the *27M* except it is a single-phase element only operating from the Auxiliary VT input. The Alarm Delay is the time period a LOP must occur before the device initiates a »LOP BLO« signal that can be used to block other elements like *51V* (Voltage Restraint).


27A[1]...[n]
Name = 27A[1]...[n]
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
V
RMS
Name.V<
AND
Name.t
t
0
Name.Pickup
14
31
Name.Trip
AND
Name.TripCmd
15
23
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters of the Aux. Undervoltage Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Aux. Undervoltage Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Aux-V-Prot /27A[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Aux-V-Prot /27A[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Aux-V-Prot /27A[1]]

Setting Group Parameters of the Aux. Undervoltage Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /27A[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /27A[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /27A[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /27A[1]]
Pickup	Vn refers to either the primary or secondary voltage of the aux VT. Only available if: Device Planning: 59.Mode = V<	0.01 - 2.00Vn	27A[1]: 0.8Vn 27A[2]: 0.9Vn	[Protection Para /<n> /Aux-V-Prot /27A[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t	Tripping delay	0.00 - 300.00s	27A[1]: 10s 27A[2]: 2.00s	[Protection Para /<n> /Aux-V-Prot /27A[1]]

Aux. Undervoltage Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Aux-V-Prot /27A[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Aux-V-Prot /27A[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Aux-V-Prot /27A[1]]

Aux. Undervoltage Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup Residual Voltage Supervision-Element
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Aux. Undervoltage

Object to be tested:
Aux. undervoltage protection elements.

Necessary components:
- One-phase AC voltage source;
- Timer for measuring of the tripping time; and
- Voltmeter.

Procedure (for each element):

Testing the threshold values
For testing the threshold and dropout values, the test voltage at the measuring input for the residual voltage has to be decreased until the relay is activated. When comparing the displayed values with those of the voltmeter, the deviation must be within the permissible tolerances.

Testing the trip delay
For testing the trip delay, a timer is to be connected to the contact of the associated trip relay. The timer is started when the limiting value of the tripping voltage is reached and it is stopped when the relay trips.

Testing the dropout ratio
Increase the measuring quantity to more than 103% of the trip value. The relay must only dropout at a maximum of 103% of the trip value.

Successful test result
The measured threshold values, trip delays, and dropout ratios comply with those specified in the adjustment list. Permissible deviations/tolerances can be taken from the Technical Data.

59A – Auxiliary Overvoltage Protection Module

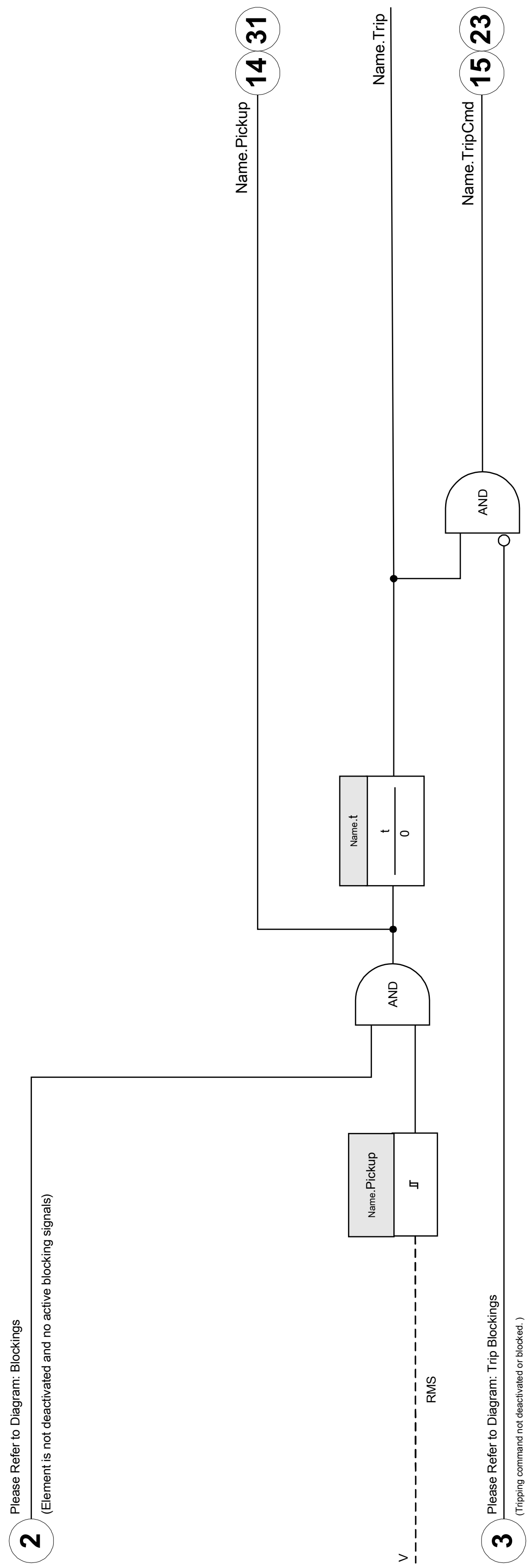
Available elements:
59A[1] ,59A[2]

NOTICE **All elements are identically structured.**

This is the 59 device Overvoltage setting for the Auxiliary VT. This device setting works exactly the same as the 59M, except it is a single-phase element only operating from the Auxiliary VT input.

59A[1]...[n]

Name = 59A[1]...[n]



Device Planning Parameters of the Aux. Overvoltage Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Aux. Overvoltage Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Aux-V-Prot /59A[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Aux-V-Prot /59A[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Aux-V-Prot /59A[1]]

Setting Group Parameters of the Aux. Overvoltage Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /59A[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /59A[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /59A[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Aux-V-Prot /59A[1]]
Pickup	Vn refers to either the primary or secondary voltage of the aux VT. Only available if: Device Planning: 59.Mode = V>	0.01 - 2.00Vn	59A[1]: 1.2Vn 59A[2]: 1.1Vn	[Protection Para /<n> /Aux-V-Prot /59A[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t	Tripping delay	0.00 - 300.00s	59A[1]: 10s 59A[2]: 2.00s	[Protection Para /<n> /Aux-V-Prot /59A[1]]

Aux. Overvoltage Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Aux-V-Prot /59A[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Aux-V-Prot /59A[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Aux-V-Prot /59A[1]]

Aux. Overvoltage Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup Residual Voltage Supervision-Element
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Aux. Overvoltage

Object to be tested:
Aux. Overvoltage protection elements.

Necessary components:
- One-phase AC voltage source;
- Timer for measuring of the tripping time; and
- Voltmeter.

Procedure (for each element):

Testing the threshold values
For testing the threshold and dropout values, the test voltage at the measuring input for the voltage has to be increased until the relay is activated. When comparing the displayed values with those of the voltmeter, the deviation must be within the permissible tolerances.

Testing the trip delay
For testing the trip delay a timer is to be connected to the contact of the associated trip relay. The timer is started when the limiting value of the tripping voltage is exceeded and it is stopped when the relay trips.

Testing the dropout ratio
Reduce the measuring quantity to less than 97% of the trip value. The relay must only dropout at a minimum of 97% of the trip value.

Successful test result
The measured threshold values, trip delays, and dropout ratios comply with those specified in the adjustment list. Permissible deviations/tolerances can be taken from the Technical Data.

59N - Neutral Overvoltage Protection

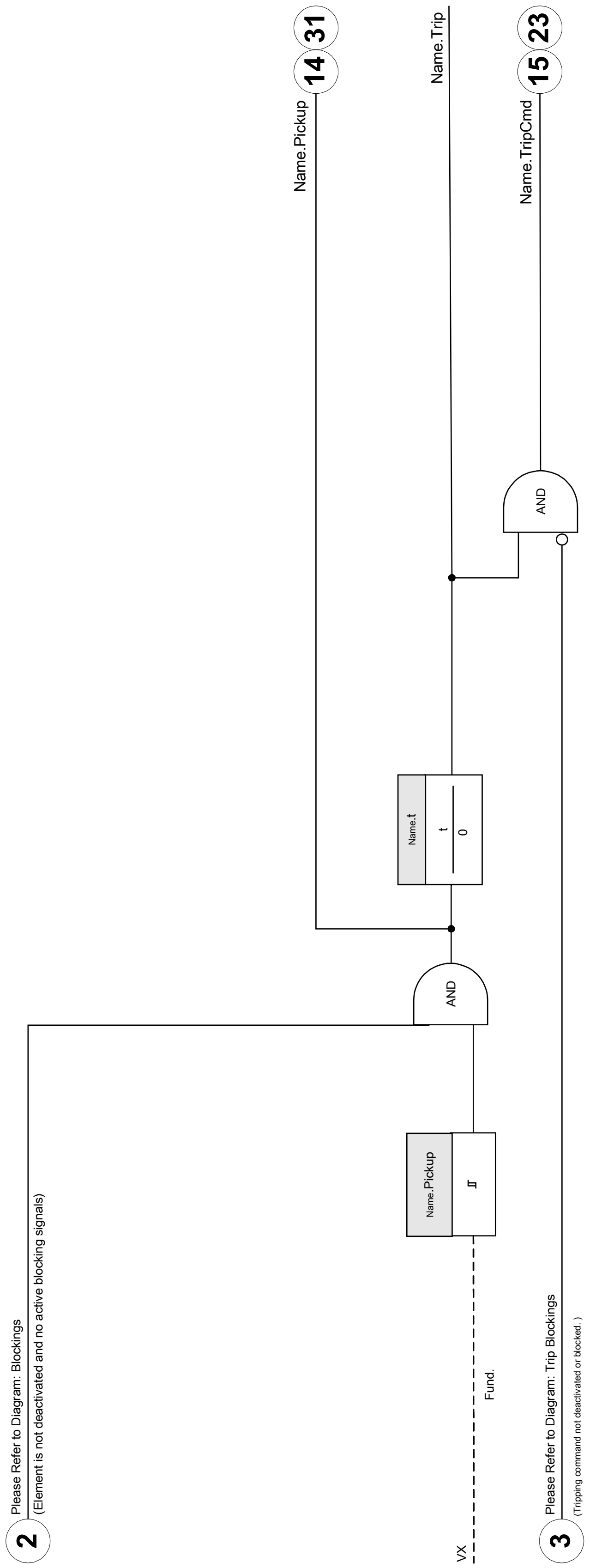
Available elements:
59N[1] ,59N[2]

NOTICE **All elements are identically structured.**

This is the 59 device for the Neutral Overvoltage settings. This element offers a criterion setting. The criterion setting tells if the threshold is based on the fundamental (Phasor) or RMS.

59N[1]...[n]

Name = 59N[1]...[n]



Device Planning Parameters of the Neutral Overvoltage Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Neutral Overvoltage Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Neutral-V-Prot /59N[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Neutral-V-Prot /59N[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Neutral-V-Prot /59N[1]]

Setting Group Parameters of the Neutral Overvoltage Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Neutral-V-Prot /59N[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Neutral-V-Prot /59N[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Neutral-V-Prot /59N[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Neutral-V-Prot /59N[1]]
Pickup	Vn refers to either the primary or secondary voltage of the aux VT. Only available if: Device Planning: 59.Mode = V>	0.01 - 2.00Vn	59N[1]: 0.4Vn 59N[2]: 0.3Vn	[Protection Para /<n> /Neutral-V-Prot /59N[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
t	Tripping delay	0.00 - 300.00s	59N[1]: 5.00s 59N[2]: 2.00s	[Protection Para /<n> /Neutral-V-Prot /59N[1]]

Neutral Overvoltage Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Neutral-V-Prot /59N[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Neutral-V-Prot /59N[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Neutral-V-Prot /59N[1]]

Neutral Overvoltage Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup Residual Voltage Supervision-Element
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Neutral Overvoltage Protection

Object to be tested:
Neutral overvoltage protection elements.

Necessary components:
- One-phase AC voltage source;
- Timer for measuring of the tripping time; and
- Voltmeter.

Procedure (for each element):

Testing the threshold values
For testing the threshold and dropout values, the test voltage at the measuring input for the voltage has to be increased until the relay is activated. When comparing the displayed values with those of the voltmeter, the deviation must be within the permissible tolerances.

Testing the trip delay
For testing the trip delay, a timer is to be connected to the contact of the associated trip relay. The timer is started when the limiting value of the tripping voltage is exceeded and it is stopped when the relay trips.

Testing the dropout ratio
Reduce the measuring quantity to less than 97% of the trip value. The relay must only dropout at a minimum of 97% of the trip value.

Successful test result
The measured threshold values, trip delays, and dropout ratios comply with those specified in the adjustment list. Permissible deviations/tolerances can be taken from the Technical Data.

47 – Voltage Unbalance

Available elements:
47[1] ,47[2]

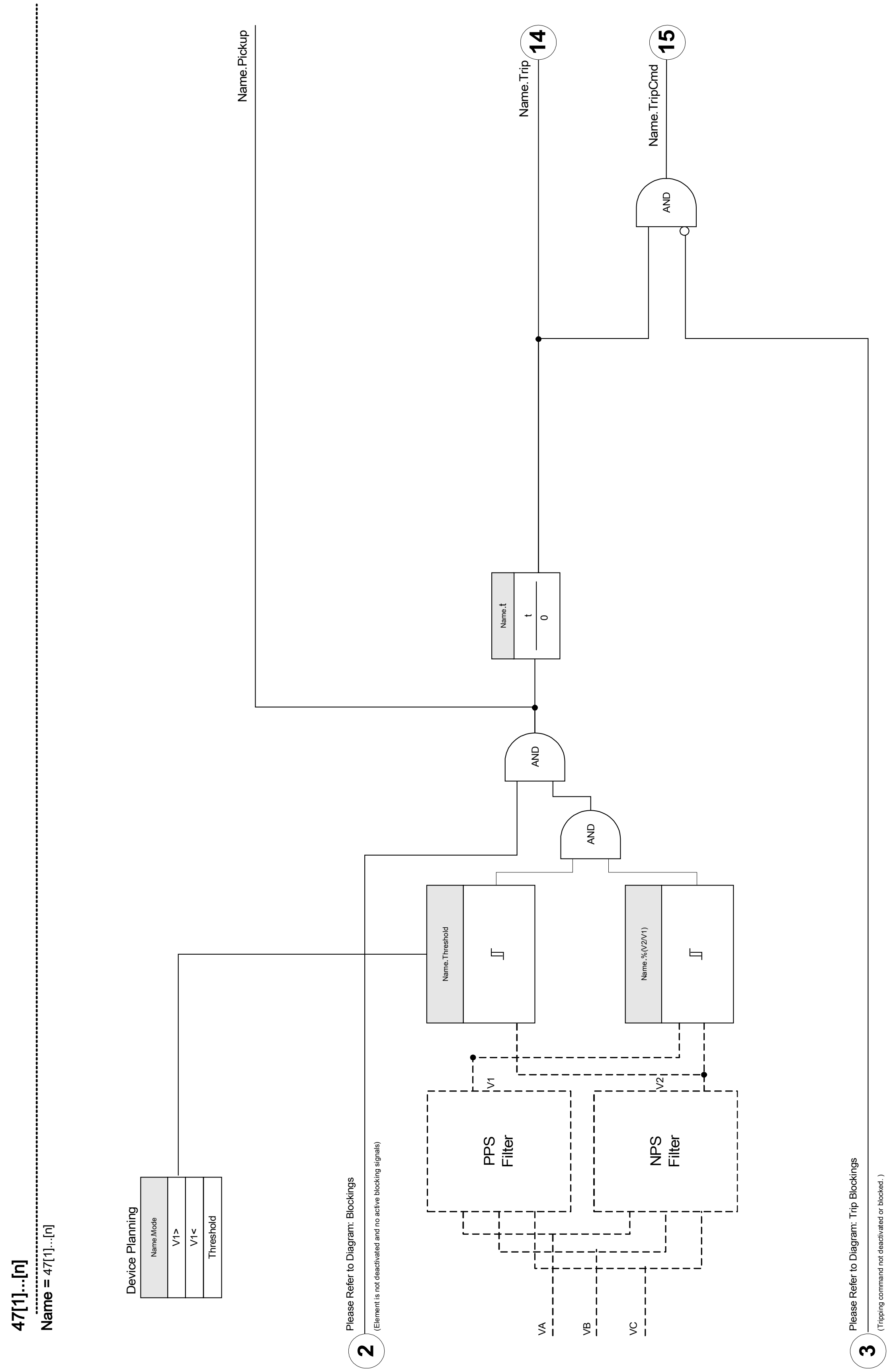
This is the 47 device Voltage Unbalance setting, which consists of the Threshold, %(V2/V1), and Delay settings. The voltage unbalance function is based on the Main VT system 3-phase voltages.

The positive and negative sequence voltages are calculated from the 3-phase voltages. The Threshold setting defines a minimum operating voltage magnitude of either V1 or V2 for the 47 function to operate, which ensures that the relay has a solid basis for initiating a voltage unbalance trip. This is a supervisory function and not a trip level.

The %(V2/V1) setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence voltage to positive sequence voltage (% Unbalance=V2/V1), or %(V2/V1) for ABC rotation and %(V1/V2) for ACB rotation. The device will automatically select the correct ratio based on the Phase Sequence setting in the System Configuration group described above.

This function requires positive or negative sequence voltage magnitude above the threshold setting and the percentage voltage unbalance above the %(V2/V1) setting before allowing a voltage unbalance trip. Therefore, both the threshold and percent settings must be met for the specified Delay time setting before the relay initiates a trip for voltage unbalance.

The voltage unbalance pickup and trip functions are reset when the positive and negative sequence voltages V1 and V2 drop below the Threshold setting or (V2/V1) drops below the %(V2/V1) setting minus 1%.


47[1]...[n]
Name = 47[1]...[n]
Device Planning
Name.Mode
V1>
V1<
Threshold
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
VA
VB
VC
PPS Filter
NPS Filter
V1
V2
Name.Threshold
Name.%(V2/V1)
AND
AND
Name.t
t
0
Name.Pickup
Name.Trip
14
AND
Name.TripCmd
15
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

Device planning parameters of the asymmetry module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Unbalance Protection: Supervision of the Voltage System	Do not use, Use	Use	[Device Planning]

Global protection parameter of the asymmetry-module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.1	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Unbalance-Prot /47[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.2	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Unbalance-Prot /47[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Unbalance-Prot /47[1]]

Parameter set parameters of the asymmetry module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /47[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /47[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /47[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /47[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Threshold	The Threshold defines a minimum operating voltage magnitude of either V1 or V2 for the 47 function to operate, which ensures that the relay has a solid basis for initiating a voltage unbalance trip. This is a supervisory function and not a trip level. The meaning of Vn: Phase to Phase: Vn = Main VT sec. Phase to Ground: Vn = Main VT / SQRT(3). Only available if: Device Planning: 47.Mode = Threshold	0.01 - 2.00Vn	0.2Vn	[Protection Para /<n> /Unbalance-Prot /47[1]]
%(V2/V1)	The %(V2/V1) setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence voltage to positive sequence voltage (% Unbalance=V2/V1), or %(V2/V1) for ABC rotation and %(V1/V2) for ACB rotation. Only available if: %(V2/V1) = Use	2 - 40%	47[1]: 40% 47[2]: 20%	[Protection Para /<n> /Unbalance-Prot /47[1]]
t	Tripping delay	0.00 - 300.00s	47[1]: 10.0s 47[2]: 20s	[Protection Para /<n> /Unbalance-Prot /47[1]]
LOP Blo	Blocking if voltage transformer failure detected. LOP (Loss of Potential) Only available if: Device Planning: 47.Mode = Threshold	Inactive, Active	Inactive	[Protection Para /<n> /Unbalance-Prot /47[1]]

States of the inputs of the asymmetry module

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Unbalance-Prot /47[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Unbalance-Prot /47[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Unbalance-Prot /47[1]]

Signals of the asymmetry module (states of the outputs)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup Voltage Asymmetry
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Asymmetry Protection

Object to be tested
Test of the asymmetry protection elements.

Necessary means

- 3-phase AC voltage source
- Timer for measuring of the tripping time
- Voltmeter

Testing the tripping values (Example)

Set the pickup value for the voltage in the negative phase sequence to 0.5 Vn. Set the tripping delay to 1 s.

In order to generate a negative phase sequence voltage interchange the wiring of two phases (VL2 and VL3).

Testing the trip delay
Start the timer and abrupt change (switch) to 1.5 times of the set tripping value. Measure the trip delay.

Successful test result
The measured threshold values and trip delays comply with those specified in the adjustment list. Permissible deviations/tolerances can be taken from the Technical Data.

Frequency Protection Module [81O/U, 81R, 78V]

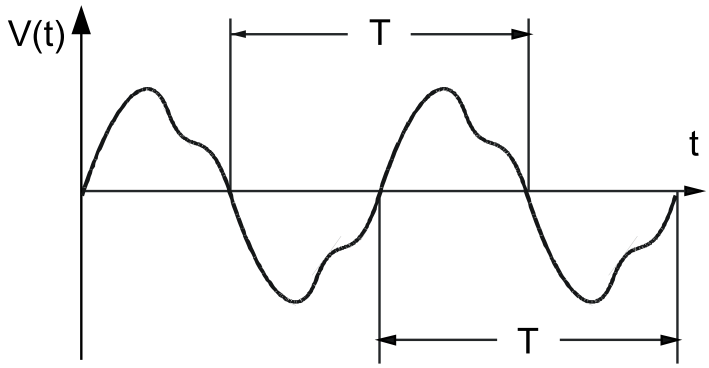
Available elements:
81[1] ,81[2] ,81[3] ,81[4] ,81[5] ,81[6]

NOTICE **All frequency protective elements are identically structured.**

Frequency - Measuring Principle

NOTICE **The frequency is calculated as the average of the measured values of the three phase frequencies. Only valid measured frequency values are taken into account. If a phase voltage is no longer measurable, this phase will be excluded from the calculation of the average value.**

The measuring principle of the frequency supervision is based in general on the time measurement of complete cycles, whereby a new measurement is started at each zero passage. The influence of harmonics on the measuring result is thus minimized.



Frequency tripping is sometimes not desired by low measured voltages which, for instance. occur during alternator acceleration. All frequency supervision functions are blocked if the voltage is lower 0.15 times Vn.

Frequency Functions

Due to its various frequency functions, the device is very flexible. That makes it suitable for a wide range of applications where frequency supervision is an important criterion.

In the *Device Planning* menu, the User can decide how to use each of the six frequency elements.

f[1] to *f[6]* can be assigned as:

•81U – Underfrequency;
•81O – Overfrequency;
•81R – Rate of Change of Frequency (df/dt);
•81UR – Underfrequency and Rate of Change of Frequency (df/dt);
•81OR – Overfrequency and Rate of Change of Frequency (df/dt);
•81UΔR – Underfrequency and DF/DT (absolute frequency change per definite time interval);
•81OΔR – Overfrequency and DF/DT (absolute frequency change per definite time interval); and
•78V – Vector Surge.

81U – Underfrequency

This protection element provides a pickup threshold and a tripping delay. If the frequency falls below the set pickup threshold, an alarm will be issued instantaneously. If the frequency remains under the set pickup threshold until the tripping delay has elapsed, a tripping command will be issued.

With this setting, the frequency element protects electrical generators, loads, or electrical operating equipment in general against underfrequency.

81O – Overfrequency

This protection element provides a pickup threshold and a tripping delay. If the frequency exceeds the set pickup threshold, an alarm will be issued instantaneously. If the frequency remains above the set pickup threshold until the tripping delay has elapsed, a tripping command will be issued.

With this setting, the frequency element protects electrical generators, loads, or electrical operating equipment in general against overfrequency.

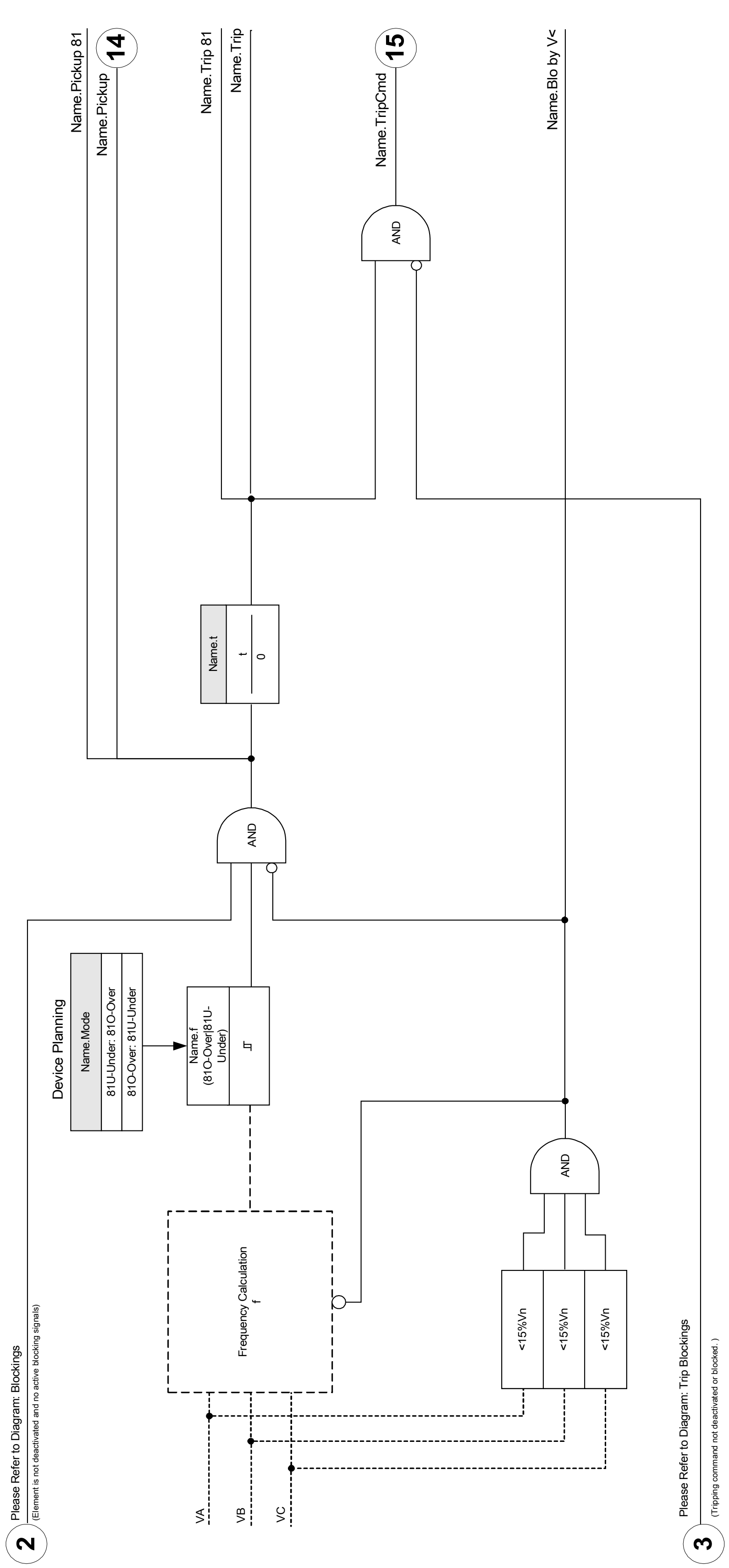
Working Principle

(Please refer to the block diagram on next page.)

The frequency element supervises the three phase voltages »*VA*«, »*VB*« and »*VC*«. If any of the three phase voltages is below 15% Vn, the frequency calculation is blocked. According to the frequency supervision mode set in the Device Planning (81U or 81O), the phase voltages are compared to the set pickup threshold for over- or under-frequency. If in any of the phases, the frequency exceeds or falls below the set pickup threshold and if there are no blocking commands for the frequency element, an alarm is issued instantaneously and the tripping delay timer is started. When the frequency still exceeds or is below the set pickup threshold after the tripping delay timer has elapsed, a tripping command will be issued.

81[1]...[n]:81U-Under Or 81O-Over

Name = 81[1]...[n]



81R Rate of Change of Frequency (df/dt)

Electrical generators running in parallel with the mains (e. g.: industrial internal power supply plants) should be separated from the mains when failure in the intra-system occurs for the following reasons:

•Damage to electrical generators must be prevented when mains voltage is recovering asynchronously (e. g.: after a short interruption).

•The industrial internal power supply must be maintained.

A reliable criterion of detecting mains failure is the measurement of the rate of change of frequency 81R (df/dt). The precondition for this is a load flow via the mains coupling point. At mains failure, the load flow change spontaneously leads to an increasing or decreasing frequency. At active power deficit of the internal power station, a linear drop of the frequency occurs and a linear increase occurs at power excess. Typical frequency gradients during application of "mains decoupling" are in the range of 0.5 Hz/s up to over 2 Hz/s.

The protective device detects the instantaneous frequency gradient 81R (df/dt) of each mains voltage period. Through multiple evaluations of the frequency gradient in sequence, the continuity of the directional change (sign of the frequency gradient) is determined. Because of this special measuring procedure, a high safety in tripping and thus a high stability against transient processes (e. g.: switching procedure) are achieved.

The frequency gradient (rate of change of frequency [df/dt]) may have a negative or positive sign, depending on frequency increase (positive sign) or decrease (negative sign).

In the frequency parameter sets, the User can define the kind of df/dt mode:

•Positive df/dt = the frequency element detects an increase in frequency;

•Negative df/dt = the frequency element detects a decrease in frequency; and

•Absolute df/dt (positive and negative) = the frequency element detects both, increase and decrease in frequency.

This protection element provides a tripping threshold and a tripping delay. If the frequency gradient df/dt exceeds or falls below the set tripping threshold, an alarm will be issued instantaneously. If the frequency gradient remains still above/below the set tripping threshold until the tripping delay has elapsed, a tripping command will be issued.

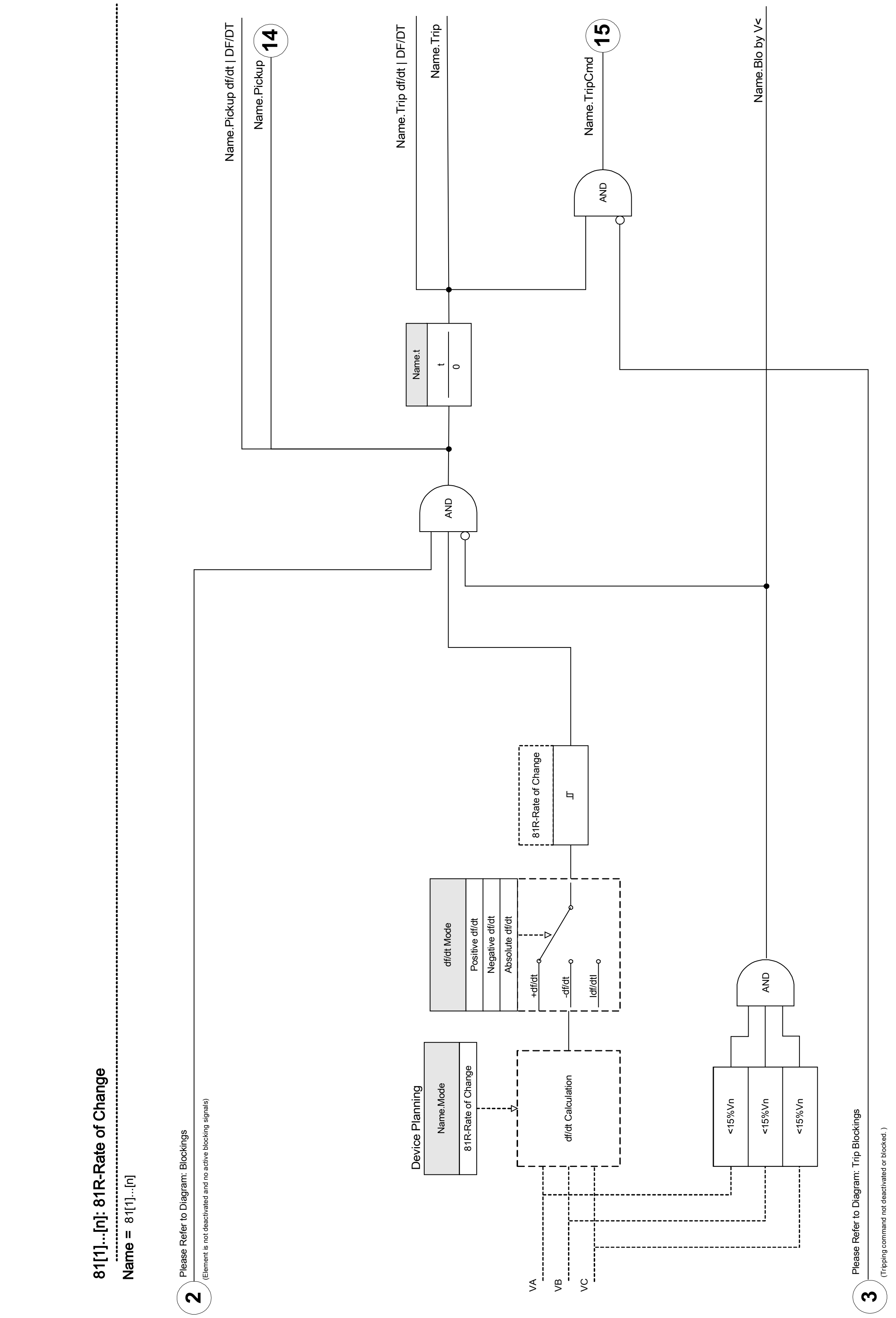
Working Principle

(Please refer to block diagram on next page.)

The frequency element supervises the three phase voltages »*VA*«, »*VB*« and »*VC*«. If any of the three phase voltages is below 15% Vn, the frequency calculation is blocked. According to the frequency supervision mode set in the Device Planning (81R), the phase voltages are compared to the set frequency gradient (df/dt) threshold. If in any of the phases, the frequency gradient exceeds or falls below the set pickup threshold (acc. to the set df/dt mode) and if there are no blocking commands for the frequency element, an alarm is issued instantaneously and the tripping delay timer is started. When the frequency gradient still exceeds or is below the set pickup threshold after the tripping delay timer has elapsed, a tripping command will be issued.

81[1]...[n]: 81R-Rate of Change

Name = 81[1]...[n]



81UR – Underfrequency and Rate of Change of Frequency (df/dt)

With this setting, the frequency element supervises if the frequency falls below a set pickup threshold and if the frequency gradient exceeds a set threshold at the same time.

In the selected frequency parameter set 81[X], an underfrequency pickup threshold f<, a frequency gradient df/dt, and a tripping delay can be set.

Whereby:

•Positive df/dt = the frequency element detects an increase in frequency;

•Negative df/dt = the frequency element detects a decrease in frequency; and

•Absolute df/dt (positive and negative) = the frequency element detects both, increase and decrease in frequency.

81OR – Overfrequency and Rate of Change of Frequency (df/dt)

With this setting, the frequency element supervises if the frequency exceeds a set pickup threshold and if the frequency gradient exceeds a set threshold at the same time.

In the selected frequency parameter set 81[X], an overfrequency pickup threshold f>, a frequency gradient df/dt, and a tripping delay can be set.

Whereby:

•Positive df/dt = the frequency element detects an increase in frequency;

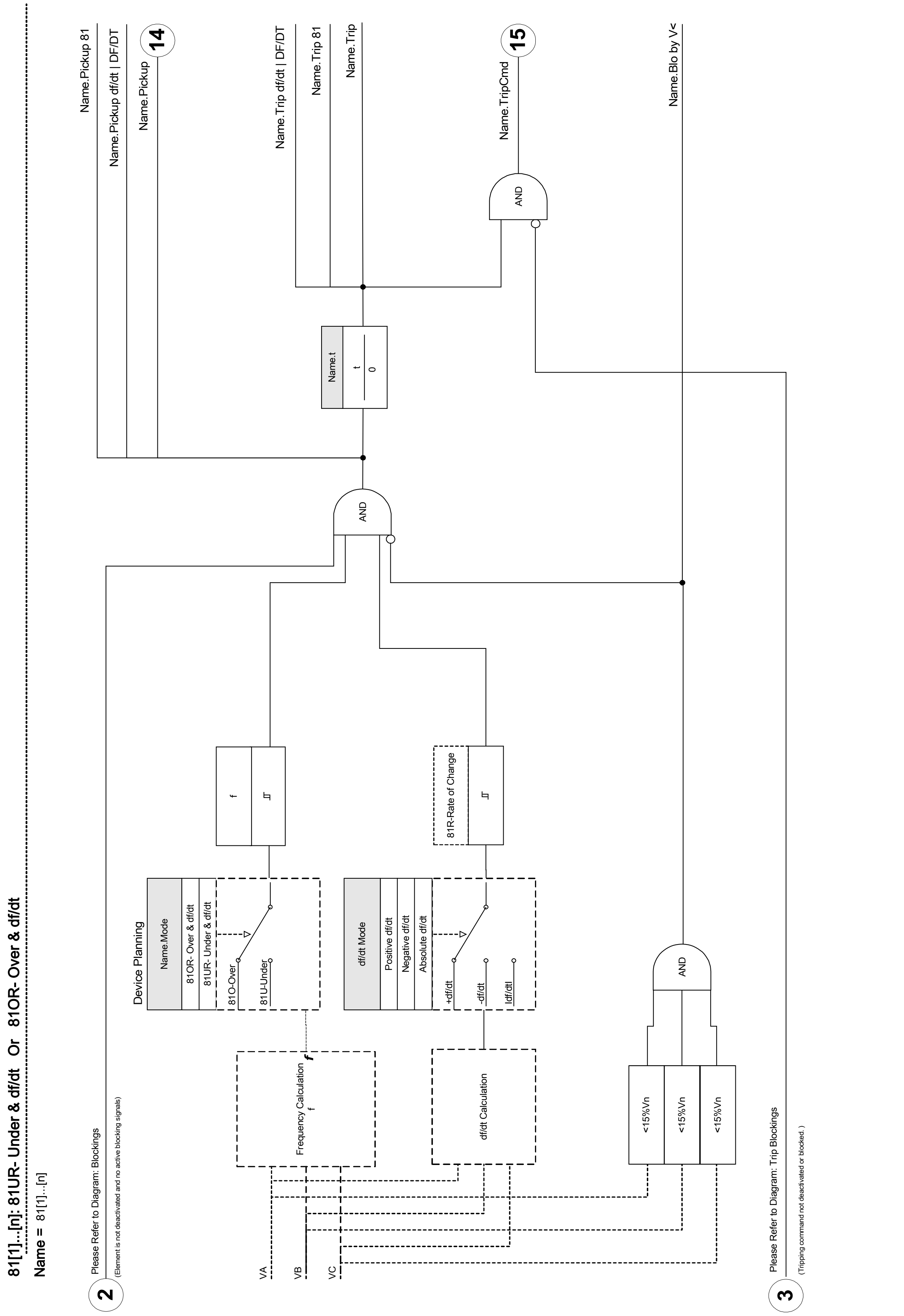
•Negative df/dt = the frequency element detects a decrease in frequency; and

•Absolute df/dt (positive and negative) = the frequency element detects both, increase and decrease in frequency.

Working Principle

(Please refer to block diagram on next page.)

The frequency element supervises the three phase voltages »*VA*«, »*VB*« and »*VC*«. If any of the three phase voltages is below 15% Vn, the frequency calculation is blocked. According to the frequency supervision mode set in the Device Planning (81UR & df/dt or 81OR & dt/dt), the phase voltages are compared to the set frequency pickup threshold and the set frequency gradient (df/dt) threshold. If in any of the phases, both the frequency and the frequency gradient exceed or falls below the set thresholds and if there are no blocking commands for the frequency element, an alarm is issued instantaneously and the tripping delay timer is started. When the frequency and the frequency gradient still exceed or are below the set threshold after the tripping delay timer has elapsed, a tripping command will be issued.


81[1]...[n]: 81UR- Under & df/dt Or 81OR- Over & df/dt
Name = 81[1]...[n]
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
VA
VB
VC
Frequency Calculation
f
df/dt Calculation
<15%Vn
<15%Vn
<15%Vn
AND
Device Planning
Name.Mode
81OR- Over & df/dt
81UR- Under & df/dt
81O-Over
81U-Under
df/dt Mode
Positive df/dt
Negative df/dt
Absolute df/dt
+df/dt
-df/dt
|df/dt|
f
81R-Rate of Change
AND
Name.t
t
0
Name.Pickup 81
Name.Pickup df/dt | DF/DT
Name.Pickup
14
Name.Trip df/dt | DF/DT
Name.Trip 81
Name.Trip
AND
Name.TripCmd
15
Name.Blo by V<
3
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)

81UΔR – Underfrequency and DF/DT

With this setting, the frequency element supervises the frequency and the absolute frequency difference during a definite time interval.

In the selected frequency parameter set 81[X], an underfrequency pickup threshold f<, a threshold for the absolute frequency difference (frequency decrease) DF and supervision interval DT can be set.

81OΔR – Overfrequency and DF/DT

With this setting, the frequency element supervises the frequency and the absolute frequency difference during a definite time interval.

In the selected frequency parameter set 81[X], an overfrequency pickup threshold f>, a threshold for the absolute frequency difference (frequency increase) DF and supervision interval DT can be set.

Working Principle

(Please refer to block diagram on next page.)

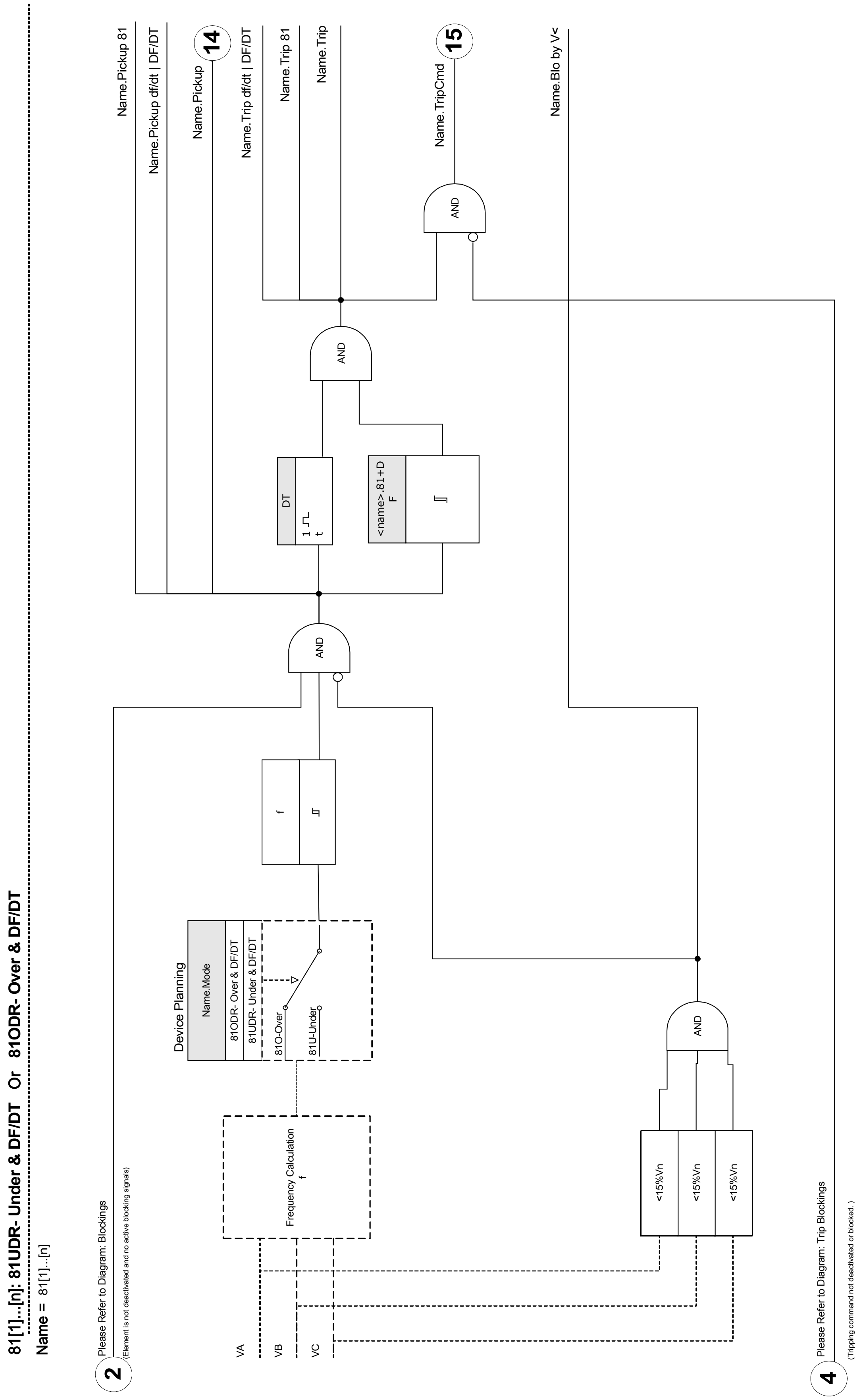
The frequency element supervises the three phase voltages »*VA*«, »*VB*« and »*VC*«. If any of the three phase voltages is below 15% Vn, the frequency calculation is blocked. According to the frequency supervision mode set in the Device Planning (81UR & DF/DT or 81OR & DF/DT), the phase voltages are compared to the set frequency pickup threshold and the set frequency decrease or increase threshold DF.
If in any of the phases, the frequency exceeds or falls below the set pickup threshold and if there are no blocking commands for the frequency element, an alarm is issued instantaneously. At the same time the timer for the supervision interval DT is started. When, during the supervision interval DT, the frequency still exceeds or is below the set pickup threshold and the frequency decrease/increase reaches the set threshold DF, a tripping command will be issued.

Working Principle of DF/DT Function

(Please refer to f(t) diagram after the block diagram.)

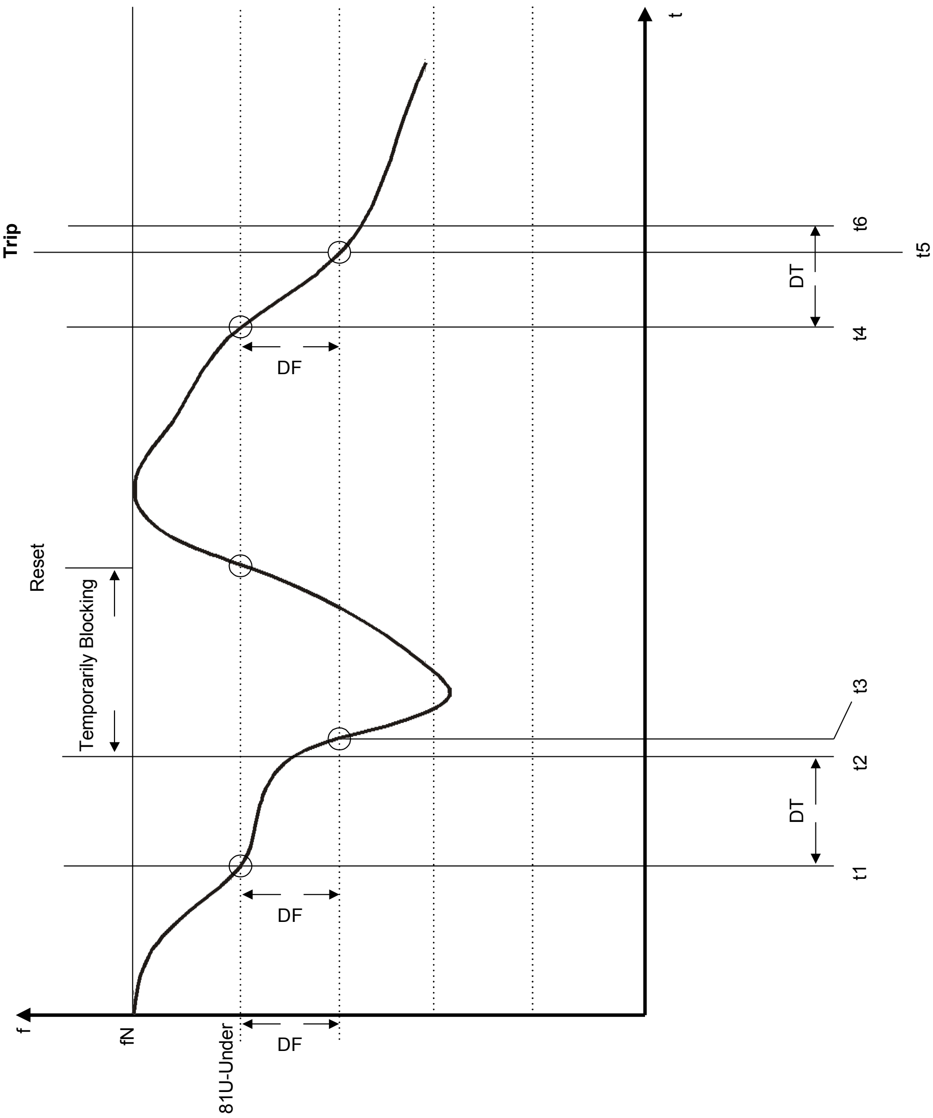
Case 1:
When the frequency falls below a set f< threshold (81U) at t1, the DF/DT element energizes. If the frequency difference (decrease) does not reach the set value DF before the time interval DT has expired, no trip will occur. The frequency element remains blocked until the frequency falls below the underfrequency threshold f< (81U) again.

Case 2:
When the frequency falls below a set f< threshold (81U) at t4, the DF/DT element energizes. If the frequency difference (decrease) reaches the set value DF before the time interval DT has expired (t5), a trip command is issued.


81[1]...[n]: 81UDR- Under & DF/DT Or 81ODR- Over & DF/DT
Name = 81[1]...[n]
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
VA
VB
VC
Frequency Calculation
f
Device Planning
Name.Mode
81ODR- Over & DF/DT
81UDR- Under & DF/DT
81O-Over
81U-Under
f
AND
DT
1
t
<name>.81+D
F
AND
AND
<15%Vn
<15%Vn
<15%Vn
AND
4
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)
Name.Pickup 81
Name.Pickup df/dt | DF/DT
Name.Pickup
14
Name.Trip df/dt | DF/DT
Name.Trip 81
Name.Trip
Name.TripCmd
15
Name.Blo by V<

81[1]...[n]: 81UDR- Under & DF/DT

Name = 81[1]...[n]



78V Vector Surge

The vector surge supervision protects synchronous generators in mains parallel operation due to very fast decoupling in case of mains failure. Very dangerous are mains auto reclosings for synchronous generators. The mains voltage returning typically after 300 ms can hit the generator in asynchronous position. A very fast decoupling is also necessary in case of long time mains failures.

Generally there are two different applications.

•Only mains parallel operation - no single operation:

In this application, the vector surge supervision protects the generator by tripping the generator circuit breaker in case of mains failure.

•Mains parallel operation and single operation:

For this application, the vector surge supervision trips the mains circuit breaker. Here it is insured that the gen.-set is not blocked when it is required as an emergency set.

A very fast decoupling in case of mains failures for synchronous generators is very difficult. Voltage supervision units cannot be used because the synchronous alternator, as well as the load impedance, support the decreasing voltage.

In this situation, the mains voltage drops only after some 100 ms below the pickup threshold of the voltage supervision and, therefore, a safe detection of mains auto reclosings is not possible with voltage supervision only.

Frequency supervision is partially unsuitable because only a highly loaded generator decreases its speed within 100 ms. Current relays detect a fault only when short-circuit type currents exist, but cannot avoid their development. Power relays are able to pickup within 200 ms, but they also cannot prevent the power from rising to short-circuit values. Since power changes are also caused by sudden loaded alternators, the use of power relays can be problematic.

Whereas the vector surge supervision of the device detects mains failures within 60 ms without the restrictions described above because it is specially designed for applications where very fast decoupling from the mains is required. Adding the typical operating time of a circuit breaker or contactor, the total disconnection time remains below 150 ms.

Basic requirement for tripping of the generator/mains monitor is a change in load of more than 15 - 20% of the rated load. Slow changes of the system frequency, for instance at regulating processes (adjustment of speed regulator), do not cause the relay to trip.

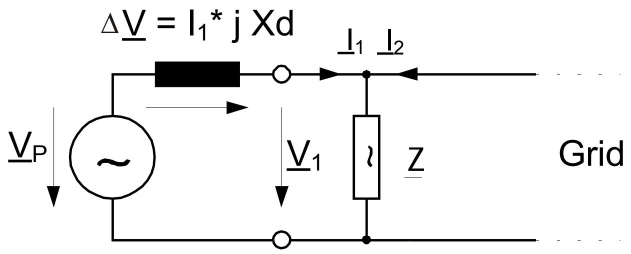
Trippings can also be caused by short-circuits within the grid, because a voltage vector surge higher than the preset value can occur. The magnitude of the voltage vector surge depends on the distance between the short-circuit and the generator. This function is also of advantage to the Power Utility Company because the mains short-circuit capacity and, consequently, the energy feeding the short-circuit is limited.

To prevent a possible false tripping, the vector surge measuring is blocked at a low input voltage <15% Vn. The undervoltage lockout acts faster then the vector surge measurement.

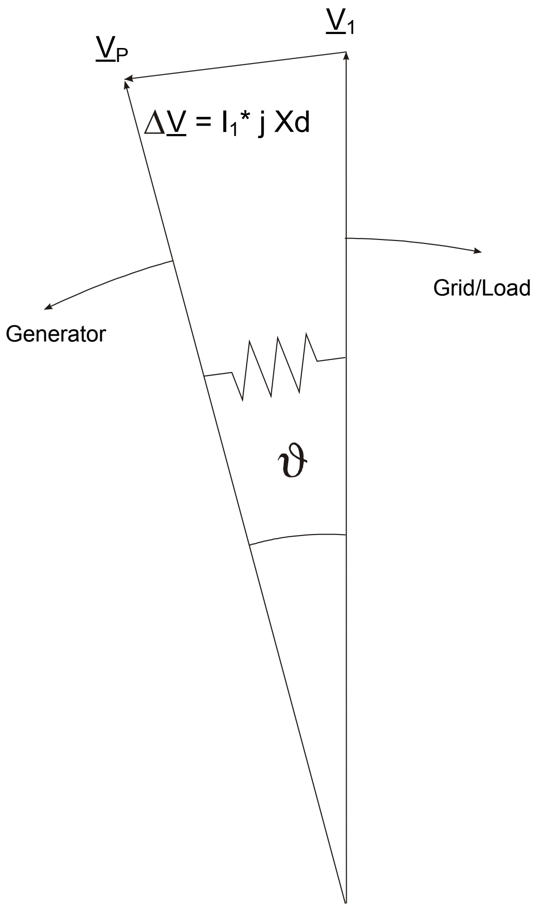
Vector surge tripping is blocked by a phase loss so that a VT fault (e. g.: faulty VTs fuse) does not cause false tripping.

Measuring Principle of Vector Surge Supervision

Equivalent circuit at synchronous generator in parallel with the mains.

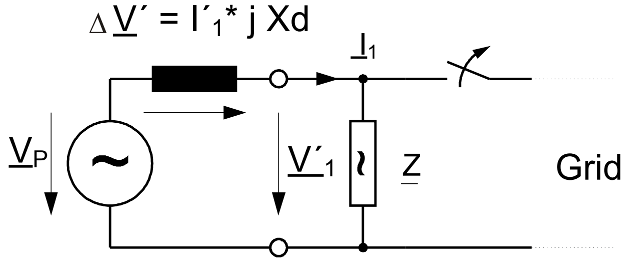


Voltage vectors at mains parallel operation.



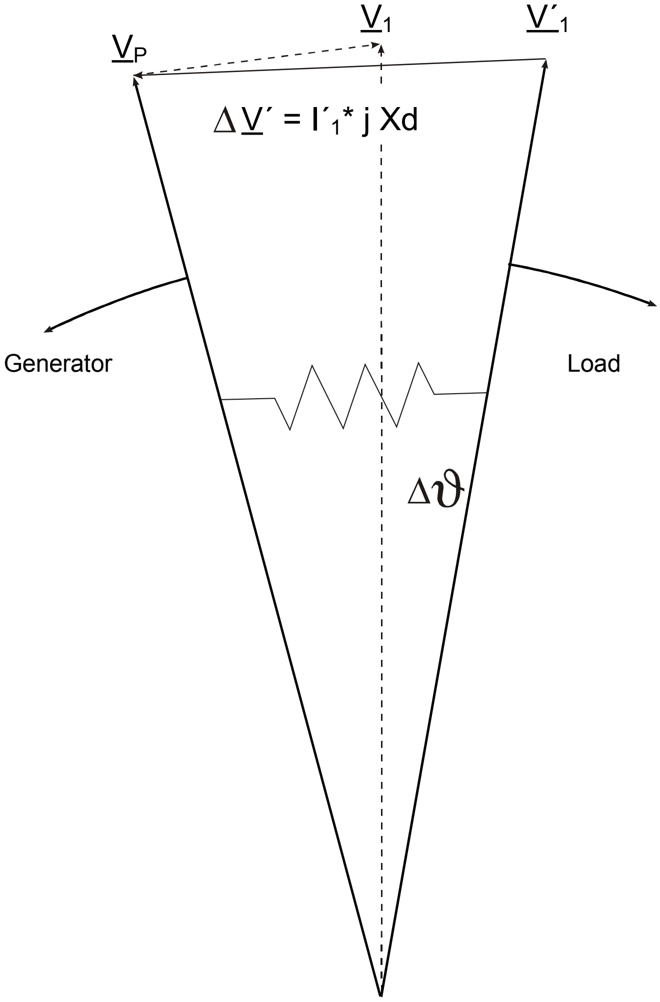
The rotor displacement angle between stator and rotor is dependent on the mechanical moving torque of the generator shaft. The mechanical shaft power is balanced with the electrical fed mains power and, therefore, the synchronous speed keeps constant.

Equivalent circuit at mains failure.

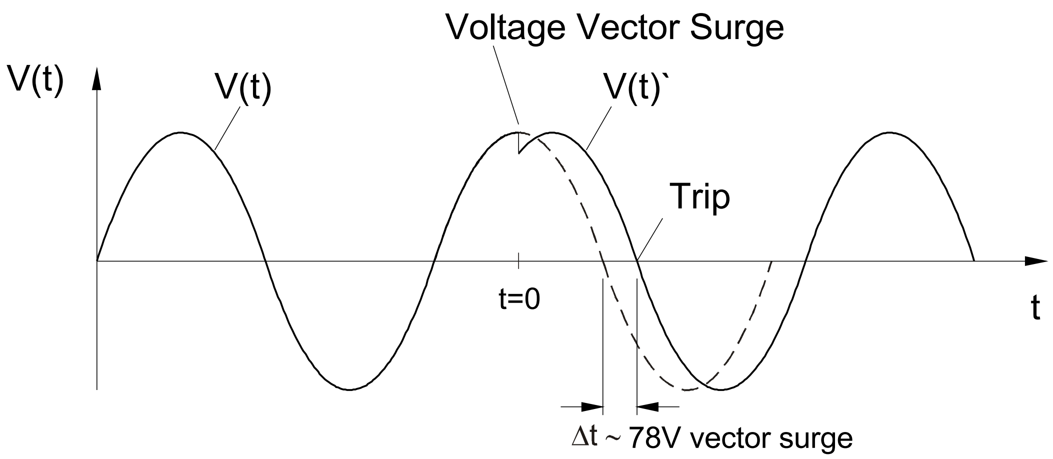


In case of mains failure or auto-reclosing, the generator suddenly feeds a very high load. The rotor displacement angle is decreased repeatedly and the voltage vector V1 changes its direction (V1').

Voltage vectors at mains failure.



Voltage vector surge.



As shown in the voltage/time diagram, the instantaneous value of the voltage jumps to another value and the phase position changes. This is called phase or vector surge.

The relay measures the cycle duration. A new measuring is started at each zero passage. The measured cycle duration is internally compared with a reference time and from this the deviation of the cycle duration of the voltage signal is ascertained. In case of a vector surge as shown in the above graphic, the zero passage occurs either earlier or later. The established deviation of the cycle duration is in compliance with the vector surge angle. If the vector surge angle exceeds the set value, the relay trips immediately.

Tripping of the vector surge is blocked in case of loss of one or more phases of the measuring voltage.

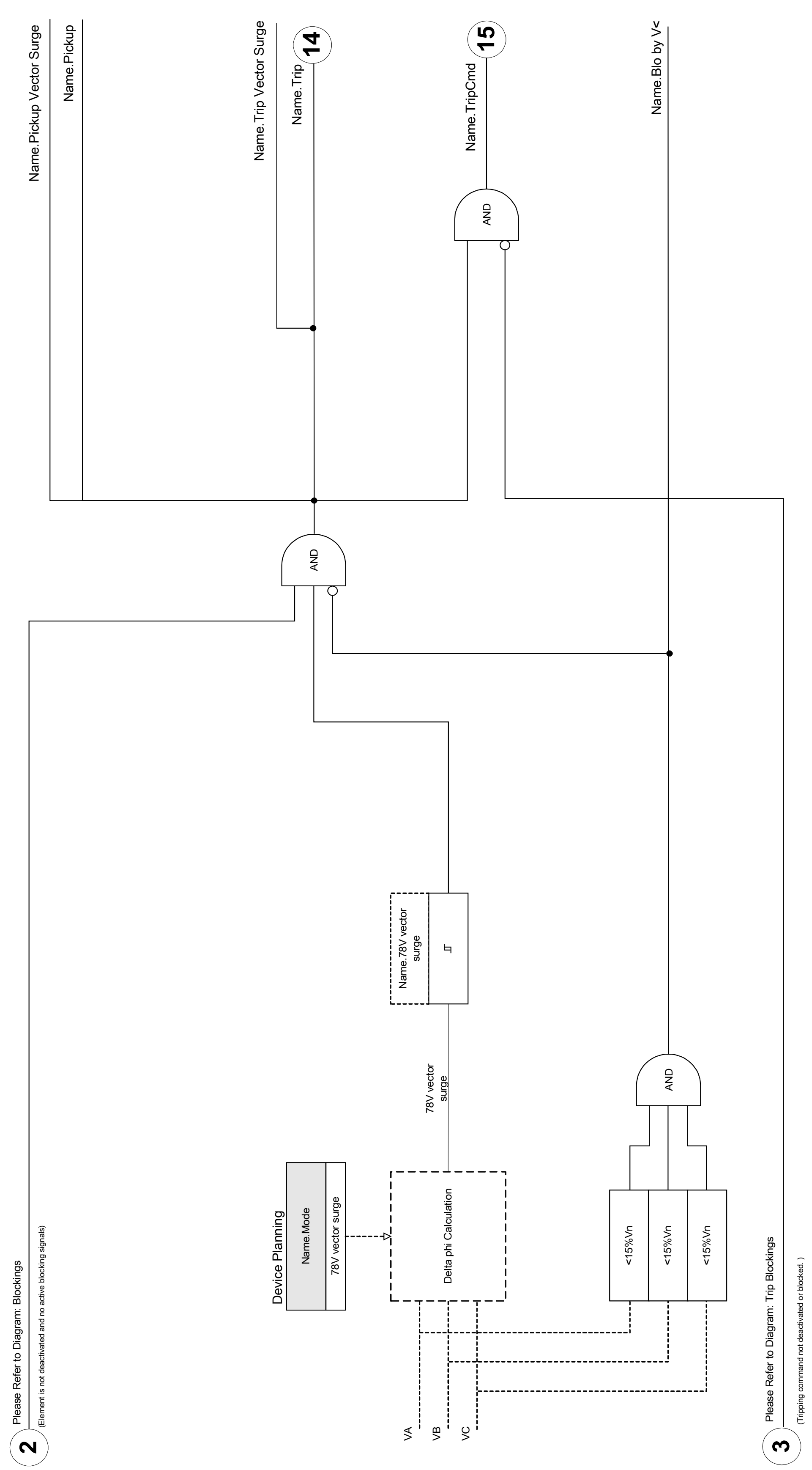
Working Principle

(Please refer to block diagram on next page.)

The vector surge element supervises the three phase voltages »*VA*«, »*VB*« and »*VC*«. If any of the three phase voltages is below 15% Vn, the vector surge calculation is blocked. According to the frequency supervision mode set in the Device Planning (78V), the phase voltages are compared to the set vector surge threshold. If in any of the phases, the vector surge exceeds the set threshold and if there are no blocking commands for the frequency element, an alarm and a trip command is issued instantaneously.

81[1]...[n]: 78V vector surge

Name = 81[1]...[n]



Device Planning Parameters of the Frequency Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, 81U-Under, 81O-Over, 81UR- Under & df/dt, 81OR- Over & df/dt, 81UDR- Under & DF/DT, 81ODR- Over & DF/DT, 81R-Rate of Change, 78V vector surge	81[1]: 81O-Over 81[2]: 81O-Over 81[3]: 81U-Under 81[4]: 81U-Under 81[5]: 81R-Rate of Change 81[6]: 81R-Rate of Change	[Device Planning]

Global Protection Parameters of the Frequency Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Freq-Prot /81[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Freq-Prot /81[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Freq-Prot /81[1]]

Setting Group Parameters of the Frequency Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Freq-Prot /81[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Freq-Prot /81[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Freq-Prot /81[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Freq-Prot /81[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
81O-Over	Pickup value for overfrequency. Only available if: Device Planning: 81.Mode = 81O-Over Or 81OR- Over & df/dt Or 81ODR-Over & DF/DT	40.00 - 69.95Hz	81[1]: 61.00Hz 81[2]: 61.0Hz 81[3]: 51.00Hz 81[4]: 51.00Hz 81[5]: 51.00Hz 81[6]: 51.00Hz	[Protection Para /<n> /Freq-Prot /81[1]]
81U-Under	Pickup value for underfrequency. Only available if: Device Planning: 81.Mode = 81U-Under Or 81UR-Under & df/dt Or 81UDR- Under & DF/DT	40.00 - 69.95Hz	81[1]: 59.0Hz 81[2]: 49.00Hz 81[3]: 59.0Hz 81[4]: 59.0Hz 81[5]: 59.0Hz 81[6]: 59.0Hz	[Protection Para /<n> /Freq-Prot /81[1]]
t	Tripping delay Only available if: Device Planning: 81.Mode = 81U-Under Or 81O-OverOr 81OR- Over & df/dt Or 81UR-Under & df/dt	0.00 - 3600.00s	1.00s	[Protection Para /<n> /Freq-Prot /81[1]]
81R-Rate of Change	Measured value (calculated): Rate-of-frequency-change. Only available if: Device Planning: 81.Mode = 81R-Rate of Change Or 81UR- Under & df/dt Or 81OR- Over & df/dt	0.1 - 10.0Hz/s	1.0Hz/s	[Protection Para /<n> /Freq-Prot /81[1]]
t-df/dt	Trip delay df/dt	0.00 - 300.00s	1.00s	[Protection Para /<n> /Freq-Prot /81[1]]

Parameter	Description	Setting Range	Default	Menu Path
DF	Frequency difference for the maximum admissable variation of the mean of the rate of frequency-change. This function is inactive if DF=0. Only available if: Device Planning: 81.Mode = 81UDR- Under & DF/DT Or 81ODR- Over & DF/ DT	0.0 - 10.0Hz	1.00Hz	[Protection Para /<n> /Freq-Prot /81[1]]
DT	Time interval of the maximum admissable rate-of-frequency-change. Only available if: Device Planning: 81.Mode = 81UDR- Under & DF/DT Or 81ODR- Over & DF/ DT	0.1 - 10.0s	1.00s	[Protection Para /<n> /Freq-Prot /81[1]]
df/dt Mode	df/dt Mode Only available if: Device Planning: 81.Mode = 81R- Rate of Change Or 81UR- Under & df/dt Or 81OR- Over & df/ dt Only available if: Device Planning: 81.Mode = 81R- Rate of Change Or 81UR- Under & df/dt Or 81OR- Over & df/ dt Only available if: Device Planning: 81.Mode = 81R- Rate of Change	Absolute df/dt, Positive df/dt, Negative df/dt	Absolute df/dt	[Protection Para /<n> /Freq-Prot /81[1]]
78V vector surge	Measured Value (Calculated): Vector Surge Only available if: Device Planning: 81.Mode = 78V vector surge	1 - 30°	10°	[Protection Para /<n> /Freq-Prot /81[1]]

Frequency Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Freq-Prot /81[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Freq-Prot /81[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Freq-Prot /81[1]]

Frequency Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo by V<	Signal: Module is blocked by undervoltage.
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup 81	Signal: Pickup Frequency Protection
Pickup df/dt | DF/DT	Pickup instantaneous or average value of the rate-of-frequency-change
Pickup Vector Surge	Signal: Pickup Vector Surge
Pickup	Signal: Pickup Frequency Protection (collective signal)
Trip 81	Signal: Frequency has exceeded the limit.
Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
Trip Vector Surge	Signal: Trip delta phi
Trip	Signal: Trip Frequency Protection (collective signal)
TripCmd	Signal: Trip Command

Commissioning: Overfrequency [ANSI 81O]

Object to be tested:
All configured overfrequency protection stages.

Necessary means:
- Three-phase voltage source with variable frequency; and
- Timer

Procedure:

Testing the threshold values
- Keep on increasing the frequency until the respective frequency element is activated;
- Note the frequency value; and
- Disconnect the test voltage.

Testing the trip delay
- Set the test voltage to nominal frequency and
- Now connect a frequency jump (activation value) and then start a timer. Measure the tripping time at the relay output.

Testing the fallback ratio:
Reduce the measuring quantity to less than 99.95% of the trip value (or 0.05% fn). The relay must only fall back at 99.95% of the trip value at the earliest (or 0.05% fn).

Successful test result:
Permissible deviations/tolerances can be taken from the Technical Data.

Commissioning: Underfrequency [ANSI 81U]

For all configured underfrequency elements, this test can be carried out similar to the test for overfrequency protection (by using the related underfrequency values).

Please consider the following deviations:

- For testing the threshold values, the frequency has to be decreased until the protection element is activated.

- For detection of the fallback ratio, the measuring quantity has to be increased to more than 100.05% of the trip value (or 0.05% fn). At 100.05% of the trip value the relay is to fall back at the earliest (or 0.05% fn).

Commissioning: 81R Rate of Change (df/dt)

Object to be tested:
All frequency protection stages that are projected as df/dt.

Necessary means:

- Three-phase voltage source and
- Frequency generator that can generate and measure a linear, defined rate of change of frequency.

Procedure:

Testing the threshold values

- Keep on increasing the rate of change of frequency until the respective element is activated and
- Note the value.

Testing the trip delay

- Set the test voltage to nominal frequency:
- Now apply a step change (sudden change) that is 1.5 times the setting value (example: apply 3 Hz per second if the setting value is 2 Hz per second); and
- Measure the tripping time at the relay output. Compare the measured tripping time to the configured tripping time.

Successful test result:
Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: 81U and Rate of Change (f< and -df/dt)

Object to be tested:
All frequency protection stages that are projected as f< and -df/dt.

Necessary means:
- Three-phase voltage source and
- Frequency generator that can generate and measure a linear, defined rate of change of frequency.

Procedure:

Testing the threshold values
- Feed nominal voltage and nominal frequency to the device:
- Decrease the frequency below the f< threshold: and
- Apply a rate of change of frequency (step change) that is below the setting value (example: apply -1 Hz per second if the setting value is -0.8 Hz per second). After the tripping delay is expired the relay has to trip.

Successful test result:
Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: 81O and Rate of Change (f> and df/dt)

Object to be tested:
All frequency protection stages that are projected as f> and df/dt.

Necessary means:
- Three-phase voltage source and
- Frequency generator that can generate and measure a linear, defined rate of change of frequency.

Procedure:

Testing the threshold values
- Feed nominal voltage and nominal frequency to the device;
- Increase the frequency above the f> threshold; and
- Apply a rate of change of frequency (step change) that is above the setting value (example: apply 1 Hz per second if the setting value is 0.8 Hz per second). After the tripping delay is expired the relay has to trip.

Successful test result:
Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: 81UΔR – Underfrequency and DF/DT

Object to be tested:
All frequency protection stages that are projected as f< and Df/Dt.

Necessary means:
- Three-phase voltage source and
- Frequency generator that can generate and measure a defined frequency change.

Procedure:

Testing the threshold values
- Feed nominal voltage and nominal frequency to the device;
- Decrease the frequency below the f< threshold; and
- Apply a defined frequency change (step change) that is above the setting value (example: apply a frequency change of 1 Hz during the set time interval DT if the setting value DF is 0.8 Hz). The relay has to trip immediately.

Successful test result:
Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: 81OΔR – Overfrequency and DF/DT

Object to be tested:
All frequency protection stages that are projected as f> and Df/Dt.

Necessary means:
- Three-phase voltage source and
- Frequency generator that can generate and measure a defined frequency change.

Procedure:

Testing the threshold values
- Feed nominal voltage and nominal frequency to the device;
- Increase the frequency above the f> threshold; and
- Apply a defined frequency change (step change) that is above the setting value (example: apply a frequency change of 1 Hz during the set time interval DT if the setting value DF is 0.8 Hz). The relay has to trip immediately.

Successful test result:
Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: Vector Surge 78V

Object to be tested:
All frequency protection stages that are projected as vector surge (78V).

Necessary means:

- Three-phase voltage source that can generate a definite step (sudden change) of the voltage pointers (phase shift).

Procedure:

Testing the threshold values

- Apply a vector surge (sudden change) that is 1.5 times the setting value (example: if the setting value is 10° apply 15°).

Successful test result:
Permissible deviations/tolerances and dropout ratio can be taken from the Technical Data.

55A and 55D - PF Protection Module

Available elements:
PF-55D[1] ,PF-55D[2] ,PF-55A[1] ,PF-55A[2]

Definition Apparent Power Factor 55A (RMS - Includes Harmonics):

The Apparent Power Factor is computed by dividing real power (watts) by volt-amperes. The apparent power factor computation includes harmonics.

$$PF_{apparent} = \frac{Watt}{VA}$$

Definition Displacement Power Factor 55D (Fundamental):

The Displacement Power Factor is computed by dividing the fundamental watts by the fundamental volt-amperes as shown below. This definition is only valid at the system fundamental operating frequency. The Displacement Power Factor isolates the fundamental portion of the Power Factor from the effects of harmonics.

$$PF_{displacement} = \frac{Watt}{\sqrt{Watt^2 + var^2}}$$

These elements supervise the Power Factor within a defined area (limits).

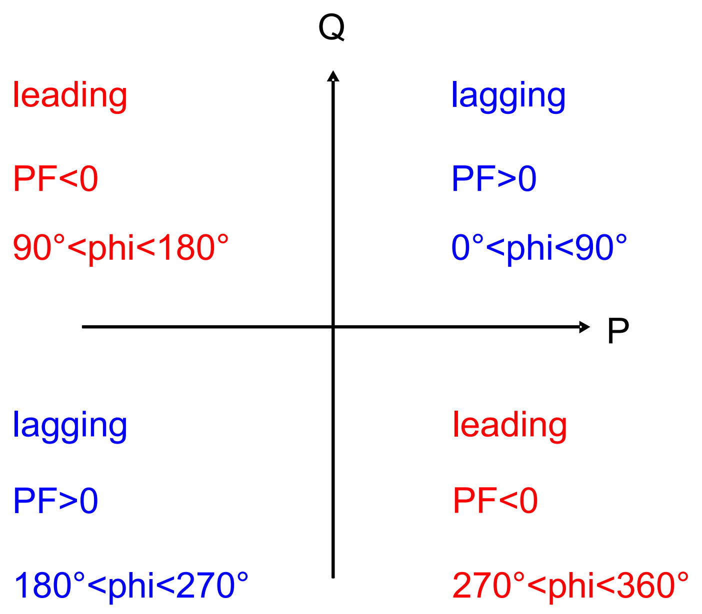
The area is defined by four parameters:

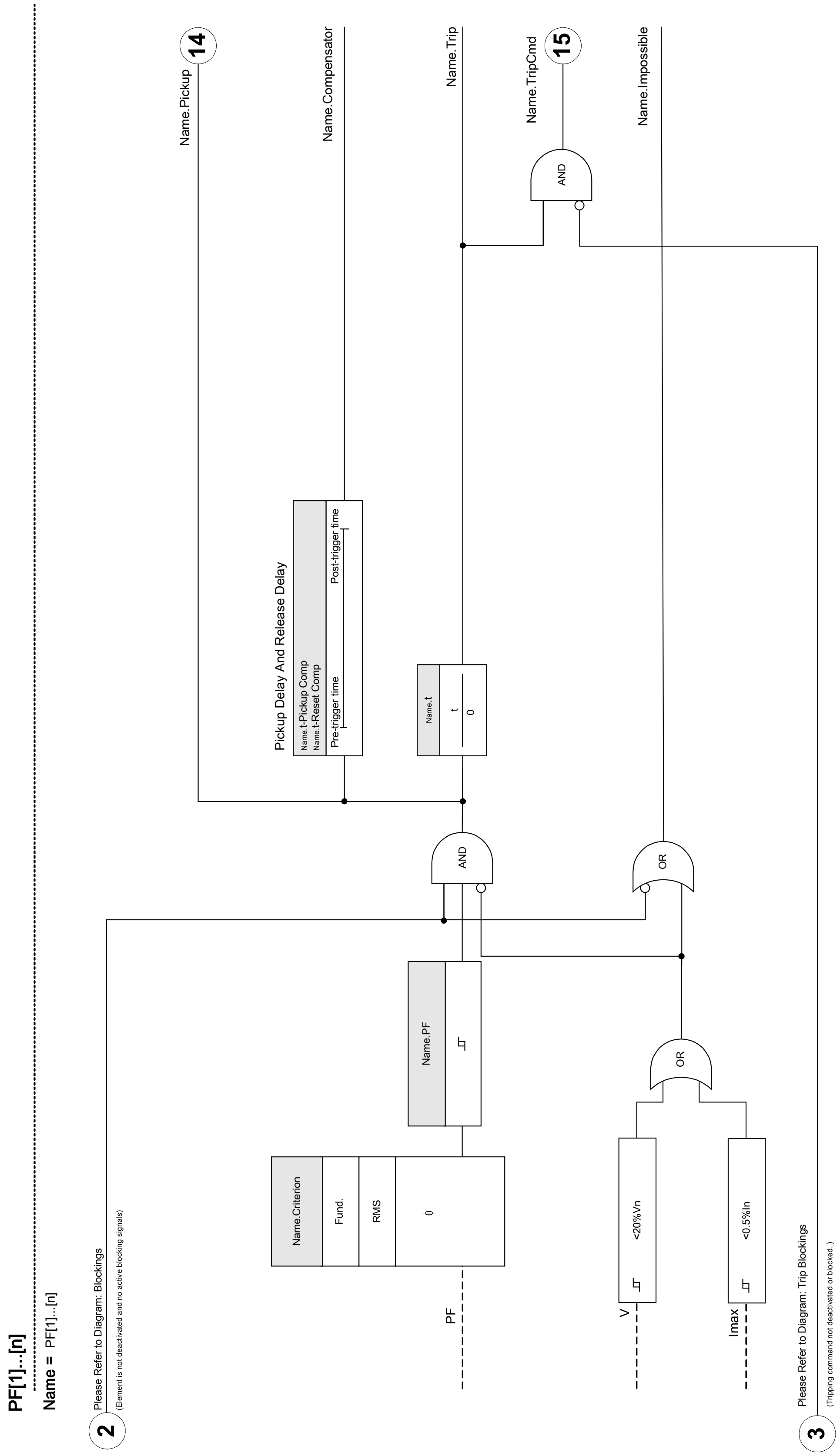
•The Trigger Quadrant (lead or lag);

•The Threshold (Power Factor value);

•The Reset Quadrant (lead or lag); and

•The Reset Value (Power Factor value).




PF[1]...[n]
Name = PF[1]...[n]
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
2
PF
V
Imax
Name.Criterion
Fund.
RMS
Name.PF
<20%Vn
<0.5%In
OR
AND
Please Refer to Diagram: Trip Blockings
(Tripping command not deactivated or blocked.)
3
Pickup Delay And Release Delay
Name.t-Pickup Comp
Name.t-Reset Comp
Pre-trigger time
Post-trigger time
Name.t
t
0
Name.Pickup
14
Name.Compensator
Name.Trip
Name.TripCmd
15
Name.Impossible

Device Planning Parameters of the Power Factor Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameter of the Power Factor Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Power Factor-Prot /PF-55D[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Power Factor-Prot /PF-55D[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Power Factor-Prot /PF-55D[1]]

Set Parameters of the Power Factor Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Trig Mode	Trigger Mode. Should the Module be triggered if the Current Pointer is leading to the Voltage Pointer = Lead? Or should the Module be triggered if the Current Pointer is lagging to the Voltage Pointer = Lag?	leading, lagging	lagging	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
Trigger-PF	This setting is the power factor, that the relay will pickup.	0.5 - 0.99	0.7	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
Res Mode	Trigger Mode. Should the Module be triggered if the Current Pointer is leading to the Voltage Pointer = Lead? Or should the Module be triggered if the Current Pointer is lagging to the Voltage Pointer = Lag?	leading, lagging	lagging	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
Reset-PF	This setting is the power factor, at which the relay will reset the power factor trip. It is like setting a hysteresis for the Trigger setting.	0.5 - 0.99	0.9	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
t-trip	Tripping delay	0.00 - 300.00s	0.00s	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]
t-Pickup Comp	Pre-trigger time for the Compensation Signal. When this timer is elapsed the compensation signal will be activated.	0.00 - 300.00s	5.00s	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]

Parameter	Description	Setting Range	Default	Menu Path
t-Reset Comp	Reset (Post-trigger) time of the Compensation Signal. When this timer is elapsed the compensation signal will be deactivated.	0.00 - 300.00s	5.00s	[Protection Para /<n> /Power Factor-Prot /PF-55D[1]]

States of the Inputs of the Power Factor Module

Name	Description	Assignment Via
ExBlo1-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /Power Factor-Prot /PF-55D[1]]
ExBlo2-I	Module Input State: External Blocking	[Protection Para /Global Prot Para /Power Factor-Prot /PF-55D[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Power Factor-Prot /PF-55D[1]]

Signals of the Power Factor Module (States of the Outputs)

Name	Description
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Pickup	Signal: Pickup Power Factor
Trip	Signal: Trip Power Factor
TripCmd	Signal: Trip Command
Compensator	Signal: Compensation Signal
Impossible	Signal: Pickup Power Factor Impossible

Commissioning: Power Factor

Object to be tested:

•Testing the projected Power Factor Modules.

Necessary means:

•Three-phase AC voltage source;
•Three-phase AC current source; and
•Timer.

Procedure – Testing the wiring:

- Feed the rated voltage and rated current to the measuring inputs of the relay.
- Adjust the current pointers 30° lagging to the voltage pointers.
- The following measuring values have to be shown:
  - P = 0.86 Pn
  - Q = 0.5 Qn
  - S = 1 Sn

NOTICE **If the measured values are shown with a negative (algebraic) sign, check the wiring.**

NOTICE **In this example, the PF-Trigger is set to 0.86 = 30° (lagging) and the PF-Reset is set to 0.86 = 30° (leading).**

Carry out the test with the settings (trigger and reset) that fit the switchboard.

Testing the threshold values (Trigger) (PF Trigger: Example = 0.86 lagging):

- Feed the rated voltage and rated current in phase to the measuring inputs of the relay (PF=1).
- Adjust the angle between the voltage and current (current pointer lagging) until the relay picks up.
- Write down the pickup value.

Testing the Reset (PF Reset: Example = 0.86 leading):

- Reduce the angle between voltage and current beyond PF = 1 (current pointer leading) until the alarm drops off.
- Write down the reset value.

Testing the trip delay (PF Trigger: Example = 0.86 lagging):

- Feed the rated voltage and rated current in phase to the measuring inputs of the relay (PF=1).
- Adjust the angle between voltage and current (current pointer lagging) with an abrupt change to PF = 0.707 (45°) lagging.
- Measure the tripping delay at the output of the relay. Compare the measured tripping time to the selected trip time.

Successful test result:

The measured total tripping delays, threshold, and reset values correspond with those values specified in the adjustment list. Permissible deviations/tolerances can be found the Technical Data section.

ExP Protection Module – External Protection

Available elements:
ExP[1] ,ExP[2] ,ExP[3] ,ExP[4]

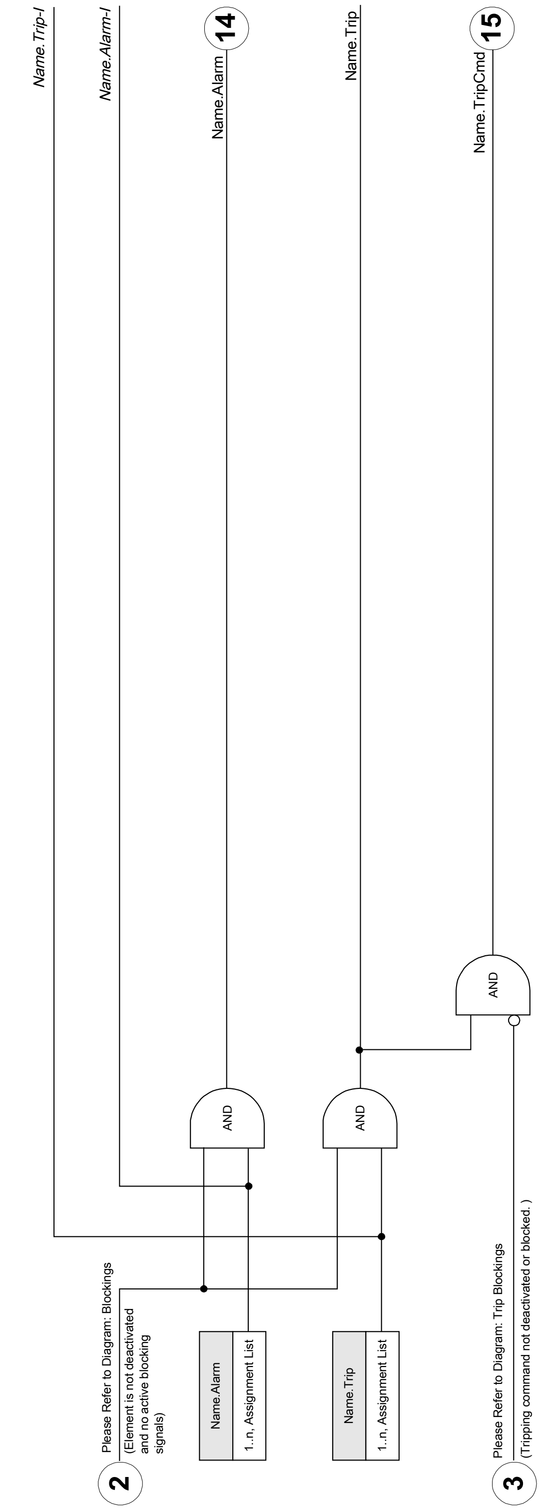
NOTICE **All four elements of the external protection *ExP[1]...[4]* are identically structured.**

By using the module *External Protection,* the following can be incorporated into the device function:

•Trip commands;
•Pickups (alarms); and
•Blockages of external protection facilities.

ExP[1]...[n]

Name = ExP[1]...[n]



Device Planning Parameters of the External Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Do not use	[Device Planning]

Global Protection Parameters of the External Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the element, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
Alarm	Assignment for External Alarm	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]
Trip	External trip of the Bkr. if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /ExP /ExP[1]]

Setting Group Parameters of the External Protection Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/element.	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo TripCmd Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /ExP /ExP[1]]

External Protection Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo TripCmd-I	Module Input State: External Blocking of the Trip Command	[Protection Para /Global Prot Para /ExP /ExP[1]]
Alarm-I	Module Input State: Alarm	[Protection Para /Global Prot Para /ExP /ExP[1]]
Trip-I	Module Input State: Trip	[Protection Para /Global Prot Para /ExP /ExP[1]]

External Protection Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: External Protection

Object to be tested:

Test of the External Protection Module.

Necessary means:

Dependent on the application.

Procedure:

Simulate the functionality of the External Protection (pickup, trip, and blockings) by (de-)energizing the digital inputs.

Successful test result:

All external pickups, external trips, and external blockings are correctly recognized and processed by the device.

BF Supervision Module – Circuit Breaker Failure Protection [ANSI 50BF]

BF

Principle – General Use

The breaker failure (BF) protection is used to provide backup protection in the event that a breaker fails to operate properly during fault clearing. A breaker failure condition is recognized if current is still flowing through the breaker after tripping or opening breaker commands have been issued for a specified time. The User can select different trigger modes. In addition, up to three additional trigger events (trip commands) can be assigned from all the protection modules.

Trigger Modes

There are three trigger modes for the breaker failure available. In addition, there are three assignable trigger inputs available.

•*All Trips*: All trip signals that are assigned to this breaker (within the breaker manager) will start the BF module.

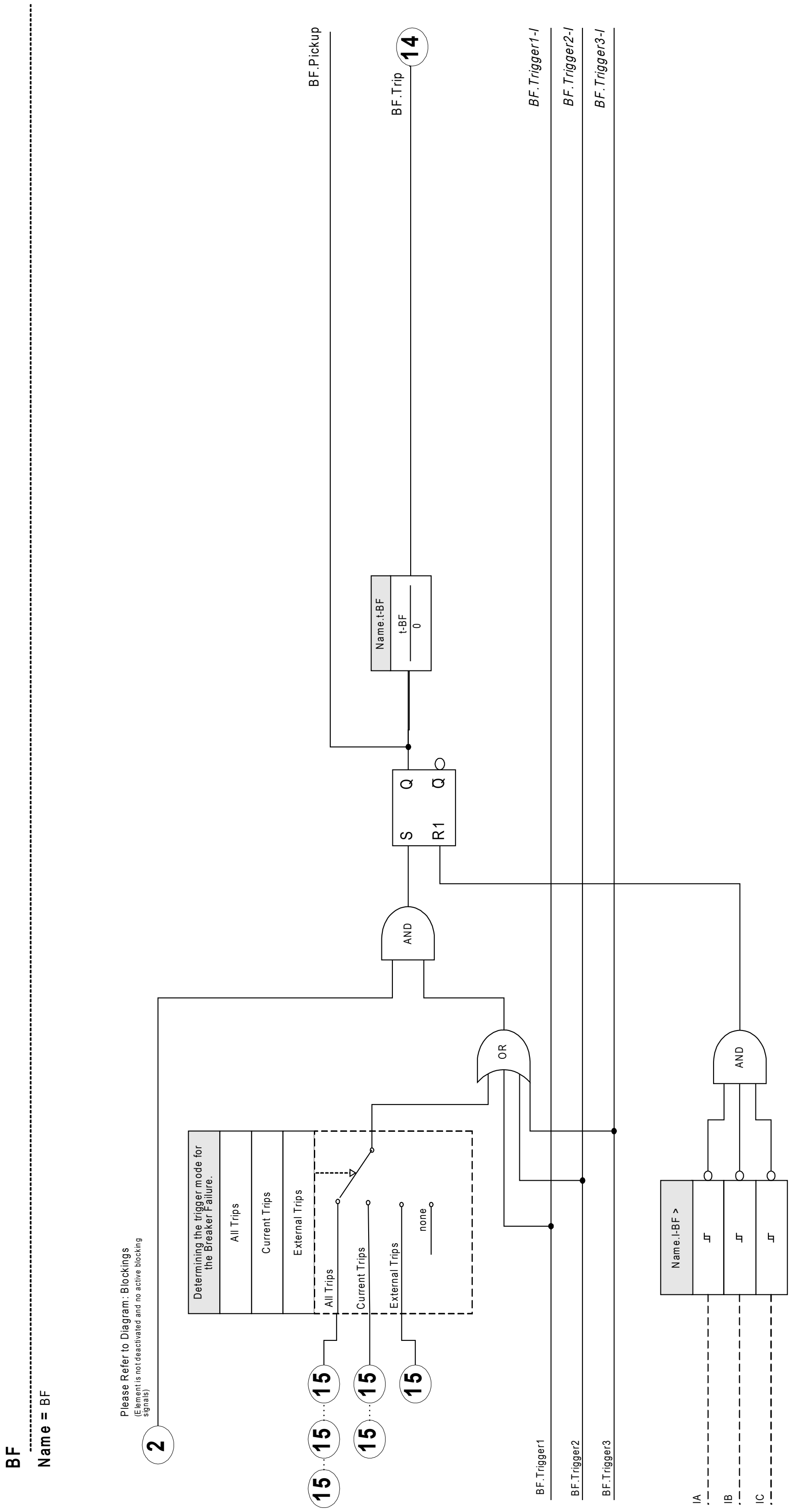
•*Current Trips*: All current trips that are assigned to this breaker (within the breaker manager) will start the BF module.

•*External Trips*: All external trips that are assigned to this breaker (within the breaker manager) will start the BF module.

•In addition, the User can also select *none* (e.g.: if the User intends to use one of the three additional assignable trigger inputs).

NOTICE **Those trips can exclusively start the breaker failures that are assigned within the breaker manager to the breaker that is to be supervised.**

NOTICE **Select the winding side from which the measured currents should be taken in case this protective device is a transformer differential protection.**


BF
Name = BF
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
2
Determining the trigger mode for the Breaker Failure.
All Trips
Current Trips
External Trips
none
15
AND
OR
S
R1
Q
Name.t-BF
t-BF
0
BF.Pickup
BF.Trip
14
BF.Trigger1-I
BF.Trigger2-I
BF.Trigger3-I
BF.Trigger1
BF.Trigger2
BF.Trigger3
Name.I-BF >
IA
IB
IC

Device Planning Parameters of the BF Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Use	Use	[Device Planning]

Global Protection Parameters of the BF Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /BF]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /BF]
Trigger	Determining the trigger mode for the Breaker Failure.	none, All Trips, Current Trips, ExP Fc	All Trips	[Protection Para /Global Prot Para /Supervision /BF]
Trigger1	Trigger that will start the BF	Trigger	-.-	[Protection Para /Global Prot Para /Supervision /BF]
Trigger2	Trigger that will start the BF	Trigger	-.-	[Protection Para /Global Prot Para /Supervision /BF]
Trigger3	Trigger that will start the BF	Trigger	-.-	[Protection Para /Global Prot Para /Supervision /BF]

Setting Group Parameters of the BF Module

NOTICE

In order to prevent a faulty activation of the BF Module, the pickup (alarm) time must be greater than the sum of:

- **The close-open time of the breaker (please refer to the technical data of the manufacturer of the breaker);**
- **+ The tripping delay of the device (please refer to the Technical Data section);**
- **+ The security margin; and**
- **+ The operating time.**

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /BF]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /BF]
I-BF >	Current level that needs to exist after Trip Command has been given.	0.00 - 0.10In	0.00In	[Protection Para /<n> /Supervision /BF]
t-BF	If the delay time is expired, an BF alarm is given out.	0.00 - 10.00s	0.20s	[Protection Para /<n> /Supervision /BF]

BF Module Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Supervision /BF]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Supervision /BF]
Trigger1	Module Input: Trigger that will start the BF	[Protection Para /Global Prot Para /Supervision /BF]
Trigger2	Module Input: Trigger that will start the BF	[Protection Para /Global Prot Para /Supervision /BF]
Trigger3	Module Input: Trigger that will start the BF	[Protection Para /Global Prot Para /Supervision /BF]

BF Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup	Signal: BF-Module Started (Pickup)
Trip	Signal: Breaker Failure Trip

These trips will start the BF module if all current functions have been selected as the trigger event.

Name	*Description*
-.-	No assignment
50P[1].TripCmd	Signal: Trip Command
50P[2].TripCmd	Signal: Trip Command
50P[3].TripCmd	Signal: Trip Command
51P[1].TripCmd	Signal: Trip Command
51P[2].TripCmd	Signal: Trip Command
51P[3].TripCmd	Signal: Trip Command
50X[1].TripCmd	Signal: Trip Command
50X[2].TripCmd	Signal: Trip Command
51X[1].TripCmd	Signal: Trip Command
51X[2].TripCmd	Signal: Trip Command
50R[1].TripCmd	Signal: Trip Command
50R[2].TripCmd	Signal: Trip Command
51R[1].TripCmd	Signal: Trip Command
51R[2].TripCmd	Signal: Trip Command
46[1].TripCmd	Signal: Trip Command
46[2].TripCmd	Signal: Trip Command
ZI.TripCmd	Signal: Zone Interlocking Trip Command

These trips will start the BF module if external trips have been selected as the trigger event.

Name	*Description*
-.-	No assignment
ExP[1].TripCmd	Signal: Trip Command
ExP[2].TripCmd	Signal: Trip Command
ExP[3].TripCmd	Signal: Trip Command
ExP[4].TripCmd	Signal: Trip Command

Commissioning: Circuit Breaker Failure Protection [ANSI 50BF]

NOTICE **The time that is configured for the BF MUST NOT be below the breaker control time, otherwise an unwanted operation of the BF is caused by any protective trip.**

Object to Be Tested:

Test of the breaker failure protection.

Necessary Means:

- Current source;
- Ammeter; and
- Timer.

NOTICE **When testing, the applied test current must always be higher than the tripping threshold *»I-BF«*. If the test current falls below the threshold while the breaker is in the "Off" position, no pickup will be generated.**

Procedure (Single-Phase):

For testing the tripping time of the BF protection, a test current has to be higher than the threshold value of one of the current protection modules that are assigned to trigger the BF protection. The BF trip delay can be measured from the time when one of the triggering inputs becomes active to the time when the BF protection trip is asserted.

To avoid wiring errors, checked to make sure the breaker in the upstream system switches off.

The time, measured by the timer, should be in line with the specified tolerances.

WARNING **Re-connect the control cable to the breaker!**

Successful Test Result:

The actual times measured comply with the setpoint times. The breaker in the higher-level section switches off.

IRIG-B00X

IRIG-B

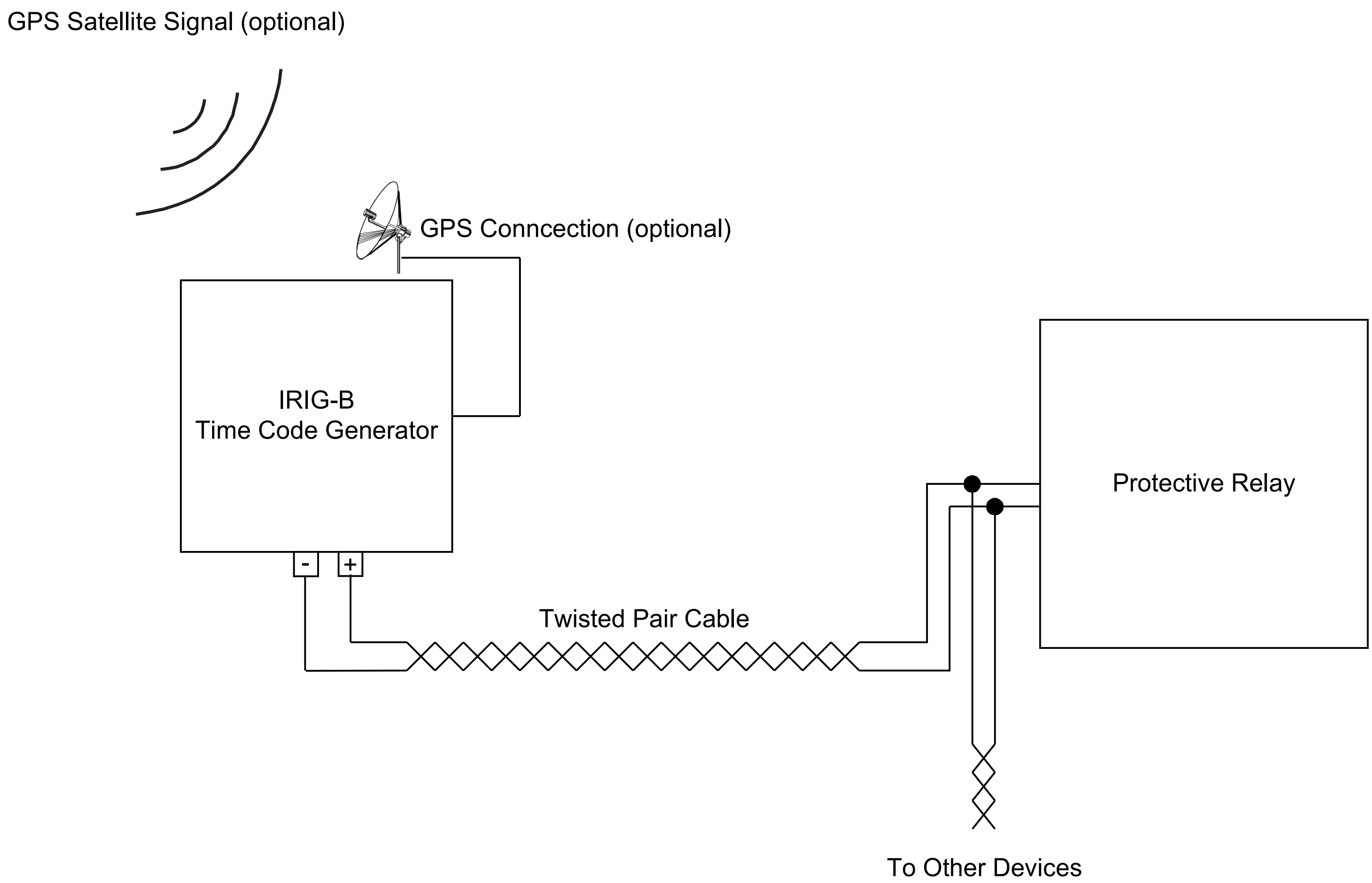
NOTICE

Requirement: A IRIG-B00X time code receiver is needed. IRIG-B004 and higher will support/transmit the "year" information.

If you are using an IRIG time code that does not support the "year" information (IRIG-B000, IRIG-B001, IRIG-B002, IRIG-B003), you have to set the "year" manually within the device. In these cases the correct year information is a precondition for a properly working IRIG-B.

Principle - General Use

This standard is the most used standard to synchronize the time of protection devices in medium voltage applications.



Based on the IRIG STANDARD 200-04, the device interface and software provides all time synchronization formats IRIG-B00X (IRIG-B000 / B001 / B002 / B003 / B004 / B005 / B006 / B007) as described in the standard. IRIG-B004 and higher will support/transmit the "year" information.

Time code B has a time frame of 1 second with an index count of 10 milliseconds and contains time-of-year and year information in a binary code decimal (BCD) format, and seconds-of-day in straight binary seconds (SBS) format.

Time accuracy of ±1ms is a requirement to synchronize the different protection devices. The location of the IRIG-B interface depends to the device type. Please see the wiring diagram supplied with the protective device.

Function

The following IRIG-B parameters can be set within the Device Parameters menu.

- Set the IRIG-B type (choose B000 through B007).
- Set the time synchronization via IRIG-B to Active or Inactive.
- Set the time zone parameter (choose one of the 36 UTC Time Zones).
- Activate or deactivate the “Daylight Savings Time” function.

NOTICE **Parameter for Daylight Savings Time (summer-winter time) has to be set manually.**

Check the wiring (wiring error) if no IRIG signal can be detected.

A signal will be issued if no IRIG-B time code is received for longer than 60 s.

IRIG-B Control Commands

In addition to the date and time information, the IRIB-B code offers the option to transmit up to 18 control commands that can be processed by the protective device. They have to be set and issued by the Time Code Generator.

The protective devices offer up to 18 IRIG-B assignment options for those control commands in order to carry out the assigned action. That means if the IRIG-B time code is fed with the corresponding state of those control commands, than they can be used for further processing within the devices (e.g.: in order to start statistics, switch on or off street lighting).

Device Planning Parameters of the IRIG-B00X

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Direct Commands of the IRIG-B00X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Res IRIG-B Cr	Resetting of the Diagnosis Counters: IRIG-B	Inactive, Active	Inactive	[Operation /Reset]

Global Protection Parameters of the IRIG-B00X

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Device Para /IRIG-B]
IRIG-B00X	Determination of the Type: IRIG-B00X. IRIG-B types differ in types of included “Coded Expressions” (year, control-functions, straight-binary-seconds).	IRIB-000, IRIB-001, IRIB-002, IRIB-003, IRIB-004, IRIB-005, IRIB-006, IRIB-007	IRIB-000	[Device Para /IRIG-B]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Time Zones	Time Zones	UTC+14 Kiritimati, UTC+13 Rawaki, UTC+12.75 Chatham Island, UTC+12 Wellington, UTC+11.5 Kingston, UTC+11 Port Vila, UTC+10.5 Lord Howe Island, UTC+10 Sydney, UTC+9.5 Adelaide, UTC+9 Tokyo, UTC+8 Hong Kong, UTC+7 Bangkok, UTC+6.5 Rangoon, UTC+6 Colombo, UTC+5.75 Kathmandu, UTC+5.5 New Delhi, UTC+5 Islamabad, UTC+4.5 Kabul, UTC+4 Abu Dhabi, UTC+3.5 Tehran, UTC+3 Moscow, UTC+2 Athens, UTC+1 Berlin, UTC+0 London, UTC-1 Azores, UTC-2 Fern. d. Noronha, UTC-3 Buenos Aires, UTC-3.5 St. John's, UTC-4 Santiago, UTC-5 New York, UTC-6 Chicago, UTC-7 Salt Lake City, UTC-8 Los Angeles, UTC-9 Anchorage, UTC-9.5 Taiohae, UTC-10 Honolulu, UTC-11 Midway Islands	UTC+0 London	[Device Para /IRIG-B]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Daylight Saving Time	Daylight Saving Time	Inactive, Active	Inactive	[Device Para /IRIG-B]

Signals of the IRIG-B00X (Output States)

Name	*Description*
Active	Signal: Active
Inverted	Signal: IRIG-B inverted
Control Signal1	Signal: IRIG-B Control Signal
Control Signal2	Signal: IRIG-B Control Signal
Control Signal4	Signal: IRIG-B Control Signal
Control Signal5	Signal: IRIG-B Control Signal
Control Signal6	Signal: IRIG-B Control Signal
Control Signal7	Signal: IRIG-B Control Signal
Control Signal8	Signal: IRIG-B Control Signal
Control Signal9	Signal: IRIG-B Control Signal
Control Signal10	Signal: IRIG-B Control Signal
Control Signal11	Signal: IRIG-B Control Signal
Control Signal12	Signal: IRIG-B Control Signal
Control Signal13	Signal: IRIG-B Control Signal
Control Signal14	Signal: IRIG-B Control Signal
Control Signal15	Signal: IRIG-B Control Signal
Control Signal16	Signal: IRIG-B Control Signal
Control Signal17	Signal: IRIG-B Control Signal
Control Signal18	Signal: IRIG-B Control Signal

IRIG-B00X Values

Value	*Description*	*Default*	*Size*	*Menu Path*
NoOfFramesOK	Total number valid Frames.	0	0 - 65535	[Operation /Count and RevData /IRIG-B]
NoOfFrameErrors	Total Number of Frame Errors. Physically corrupted Frame.	0	0 - 65535	[Operation /Count and RevData /IRIG-B]
Edges	Edges	0	0 - 65535	[Operation /Count and RevData /IRIG-B]

CTS-Supervision Module – Current Transformer Supervision

CTS

Most functions of metering, protection, and control in the relay rely on correct current measurements. It is important to make sure the CT connections and their operations are correct. The failures (including CT secondary wire broken, insulation broken down, broken wiring between CT and relay, and mismatched polarities) will cause the incorrect current measurements. The other CT errors (due to the magnetizing current that is proportional to the primary current, CT saturation, and measuring circuit and quantization error) can also cause inaccurate current measurements.

The CTS utilizes the Kirchhoff's current law to detect a CT failure and can differentiate the wiring errors from the measurement errors by adding biases to offset the measurement related errors. The biases include two terms, one of which is related to the static error that accounts for CT magnetizing characteristic differences and current measurement circuit calibration errors and other is the dynamic error that is proportional to the measured maximum current due to CT transformation characteristics. The CTs are assumed to be used in the wye-grounded winding sides. Under normal conditions, the mismatch between the calculated and the measured zero sequence current should be less than the bias value. However, if there is a CT wiring error, such relationship will not hold true. If the mismatch exceeds the bias for a specified time, an alarm will be generated.

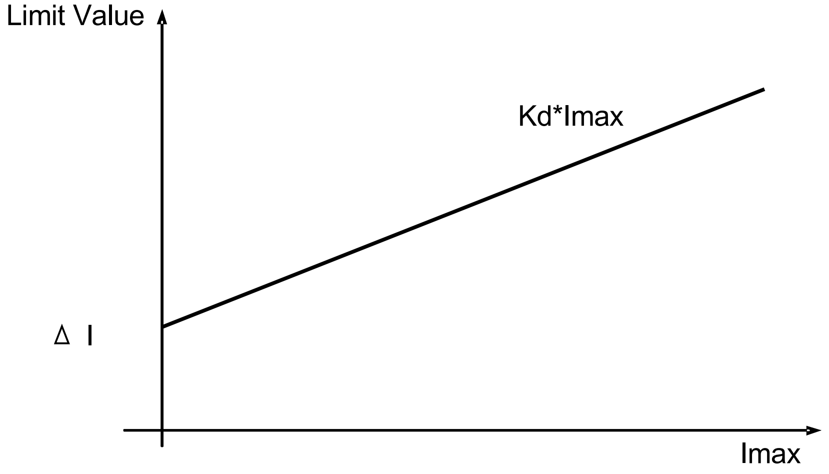
The operating principle can be expressed in terms of CT secondary currents as follow:

$$(\vec{IL}1+\vec{IL}2+\vec{IL}3)+KI*\vec{I}G=3*I0+KI*\vec{IG}\geqslant \Delta I+Kd*Imax$$

KI is the ratio of the ground CT ratio over the phase CT ratio, and it is automatically calculated from the rated system parameters.

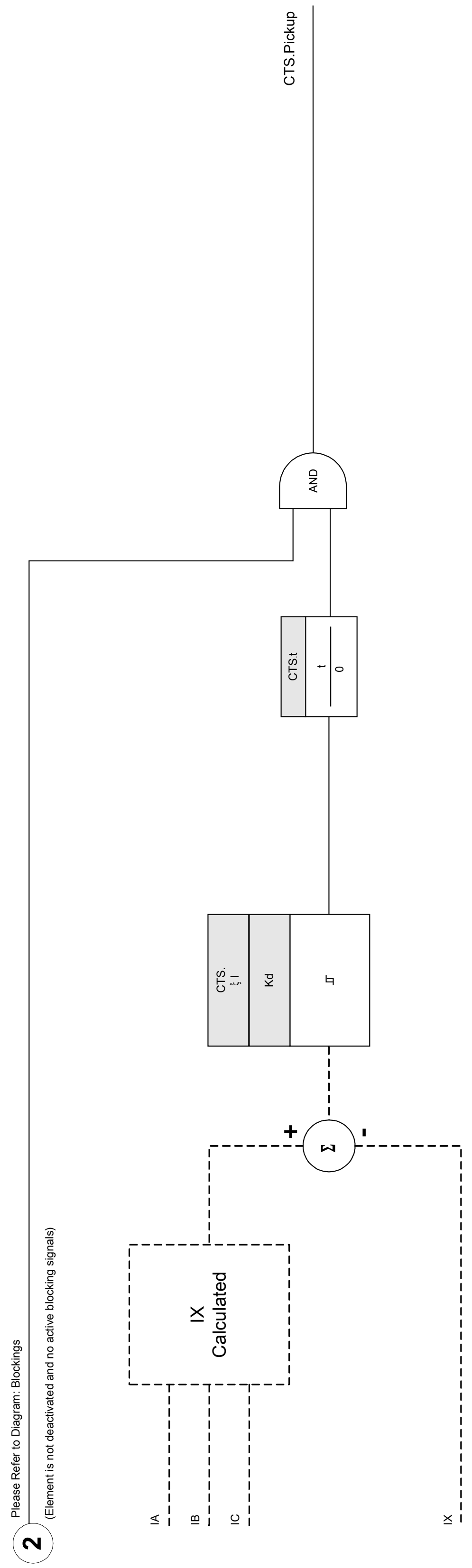
ΔI	=	The static error, a minimum mismatch allowed between the calculated and measured zero sequence current.
Kd	=	The dynamic error factor, a restrain slope that defines a percentage error generated by a high current.
Imax	=	maximum phase current.
Total bias value	=	ΔI + Kd x Imax.

The current transformer supervision operation can be graphically represented as follows.



CAUTION **If the current is measured in two phases only (for example only IA/IB) or if there is no separate ground current measuring (e.g.: normally via a zero sequence CT), the supervision function should be deactivated.**

CTS


CTS.Pickup
AND
CTS.t
t
0
CTS.
Kd
+
-
Σ
IX
Calculated
2
Please Refer to Diagram: Blockings
(Element is not deactivated and no active blocking signals)
IA
IB
IC
IX

Device Planning Parameters of the Current Transformer Supervision

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Do not use	[Device Planning]

Global Protection Parameter of the Current Transformer Supervision

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /CTS]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /CTS]

Setting Group Parameters of the Current Transformer Supervision

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /CTS]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /CTS]
ΔI	In order to prevent faulty tripping of phase selective protection functions that use the current as tripping criterion. If the difference of the measured ground current and the calculated value I0 is higher than the pick up value ΔI, an pickup event is generated after expiring of the excitation time. In such a case, a fuse failure, a broken wire or a faulty measuring circuit can be assumed.	0.10 - 1.00In	0.50In	[Protection Para /<n> /Supervision /CTS]
Pickup delay	Pickup delay	0.1 - 9999.0s	1.0s	[Protection Para /<n> /Supervision /CTS]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Kd	Dynamic correction factor for the evaluation of the difference between calculated and measured ground current. This correction factor allows transformer faults, caused by higher currents, to be compensated.	0.00 - 0.99	0.00	[Protection Para /<n> /Supervision /CTS]

Current Transformer Supervision Input States

Name	*Description*	*Assignment Via*
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Supervision /CTS]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Supervision /CTS]

Current Transformer Supervision Signals (Outputs States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup	Signal: Pickup Current Transformer Measuring Circuit Supervision

Commissioning: Current Transformer Failure Supervision

NOTICE

Preconditions:
1.Measurement of all three-phase currents (are applied to the measuring inputs of the device).
2.The ground current is detected via a zero sequence transformer (not in residual connection).

Object to Be Tested:

Check of the CT Supervision (by comparing the calculated with the measured ground current).

Necessary Means:

Three-phase current source.

Procedure, Part 1:

•Set the limiting value of the CTs to *»delta I=0.1*In«*.
•Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
•Disconnect the current of one phase from one of the measuring inputs (the symmetrical feeding at the secondary side has to be maintained).
•Make sure that the »CTS.ALARM« signal is generated.

Successful Test Result, Part 1:

The »CTS.ALARM« signal is generated.

Procedure, Part 2:

- Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
- Feed a current that is higher than the threshold value for the measuring circuit supervision to the ground current measuring input.
- Make sure that the »CTS.ALARM« signal is generated.

Successful Test Result, Part 2:

The »CTS.ALARM« signal is generated.

TCM-Supervision Module – Trip Circuit Monitoring [74TC]

TCM

The trip circuit monitoring is used for monitoring if the trip circuit is ready for opening operations. The monitoring can be fulfilled by two ways. The one way assumes only 52a is used in the trip circuit and other assumes besides 52a, 52b is also used for the circuit monitoring. Two options either 52a only (or breaker closed) or both (52a and 52b) are provided for the User to select based on use of the breaker status in the trip circuit. With 52a only in the trip circuit, the monitoring is only effective when the breaker is closed while if both 52a and 52b are used, the trip circuit will be monitored all time as long as the control power is on.

The trip circuit continuity is monitored through the digital inputs DI1 and DI2, and the breaker status 52a or 52b or both must be monitored through the other digital inputs. Note that the digital inputs used for this purpose must be configured properly based on the trip circuit control voltage and also that the de-bouncing times must be set to minimum. If the trip circuit is detected broken, an alarm will be issued with a specified delay, which must be greater than a period from the time when a trip contact is closed to the time when the breaker status is clearly recognized by the relay.

NOTICE **In Slot 1 has two digital inputs, each of which has a separate root (contact separation) for the trip circuit supervision.**

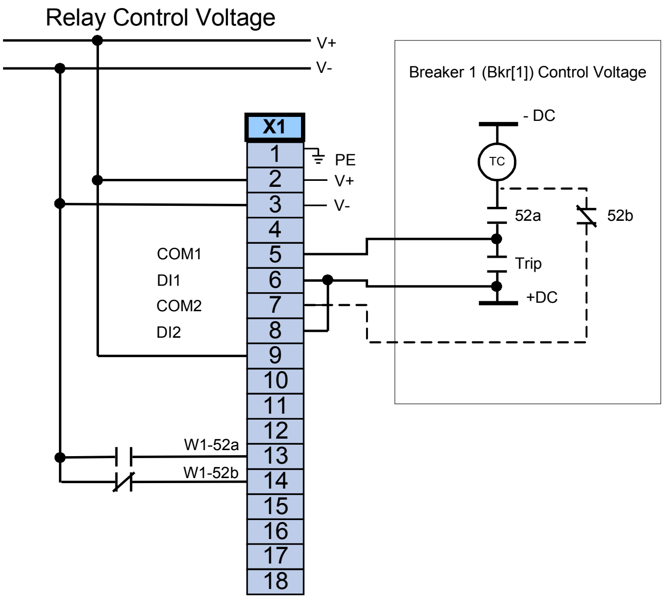
In this case, the trip circuit supply voltage serves also as supply voltage for the digital inputs and so the supply voltage failure of a trip circuit can be detected directly.

In order to identify a conductor failure in the trip circuit on the supply line or in the trip coil, the off-coil has to be looped-in to the supervision circuit.

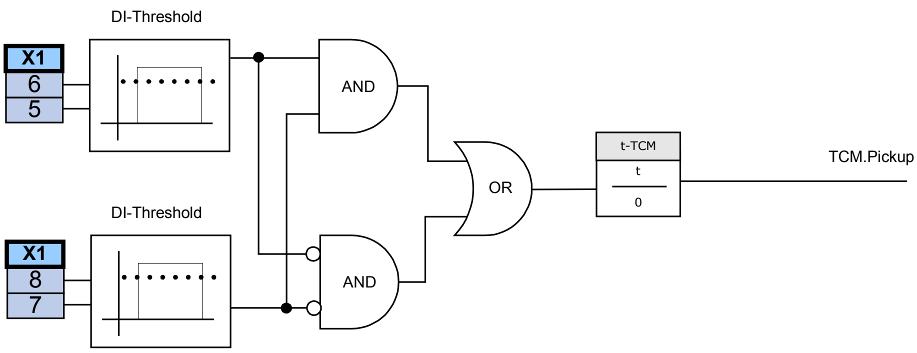
The time delay is to be set in a way that switching actions cannot cause false trips in this module.

One Breaker Application Examples

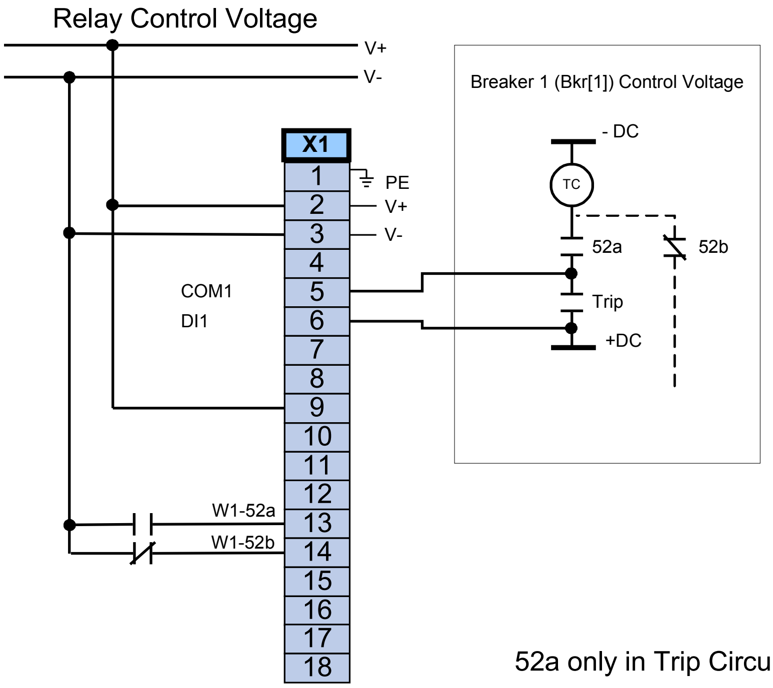
Trip Circuit Monitoring for one Breaker: Auxiliary Contacts (52a and 52b) in trip circuit.

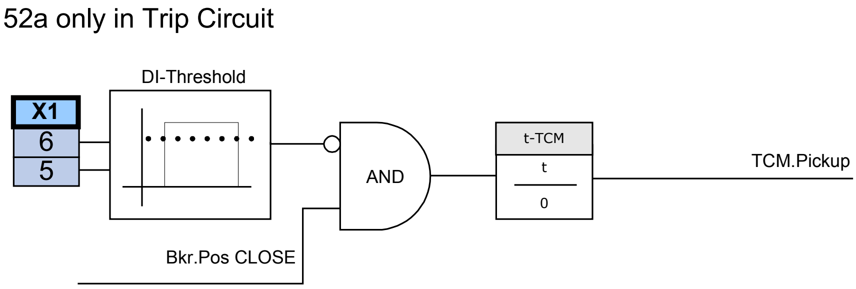


52a and 52b in Trip Circuit



Trip Circuit Monitoring for One Breaker: Auxiliary Contacts (52a Only) in Trip Circuit.





Device Planning Parameters of the Trip Circuit Monitoring Module

Parameter	*Description*	*Options*	*Default*	*Menu Path*
Mode	Mode	Do not use, Use	Use	[Device Planning]

Global Protection Parameters of the Trip Circuit Monitoring Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Mode	Select if trip circuit is going to be monitored when the breaker is closed or when the breaker is either open or close.	Closed, Either	Closed	[Protection Para /Global Prot Para /Supervision /TCM]
Input 1	Select the input configured to monitor the trip coil when the breaker is closed.	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	DI-8P X1.DI 1	[Protection Para /Global Prot Para /Supervision /TCM]
Input 2	Select the input configured to monitor the trip coil when the breaker is open. Only available if Mode set to “Either”. Only available if: Mode = Either	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	-.-	[Protection Para /Global Prot Para /Supervision /TCM]
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /TCM]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /TCM]

Setting Group Parameters of the Trip Circuit Monitoring Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Function	Permanent activation or deactivation of module/element.	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /TCM]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/element. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/elements are blocked that are parameterized "ExBlo Fc=active".	Inactive, Active	Inactive	[Protection Para /<n> /Supervision /TCM]
t-TCM	Tripping delay time of the Trip Circuit Supervision	0.10 - 10.00s	0.2s	[Protection Para /<n> /Supervision /TCM]

Trip Circuit Monitoring Module Input States

Name	*Description*	*Assignment Via*
CinBkr-52a	Position indicator/check-back signal of the Bkr (52a)	[Protection Para /Global Prot Para /Supervision /TCM]
CinBkr-52b	Module Input State: Position indicator/check-back signal of the Bkr. (52b)	[Protection Para /Global Prot Para /Supervision /TCM]
ExBlo1-I	Module Input State: External Blocking1	[Protection Para /Global Prot Para /Supervision /TCM]
ExBlo2-I	Module Input State: External Blocking2	[Protection Para /Global Prot Para /Supervision /TCM]
Bkr Pos Detect-I	Module Input State: Criterion by which the Breaker Switch Position is to be detected.	[]

Trip Circuit Monitoring Module Signals (Output States)

Name	*Description*
Active	Signal: Active
ExBlo	Signal: External Blocking
Pickup	Signal: Pickup Trip Circuit Supervision
Not Possible	Not possible because no state indicator assigned to the breaker.

Commissioning: Trip Circuit Monitoring for Breakers [74TC]

NOTICE

For breakers that trip by means of little energy (e.g.: via an optocoupler), it has to be ensured that the current applied by the digital inputs will not cause false tripping of the breaker.

Object to Be Tested:
Test of the trip circuit monitoring (with 52a and 52b contact).

Procedure, Part 1:
Simulate failure of the control voltage in the power circuits.

Successful Test Result, Part 1:
After expiration of *»t-TCM«* the trip circuit supervision, *TCM* of the device should signal an alarm.

Procedure, Part 2:
Simulate a broken cable in the breaker control circuit.

Successful Test Result, Part 2:
After expiration of *»t-TCM«,* the trip circuit supervision *TCM* of the device should signal an alarm.

Device Parameters

<u> Sys</u>

Date and Time

In the *»Device parameters/Date/Time«* menu, the User can set the date and time.

Synchronize Date and Time Via PowerPort-E

- If PowerPort-E is not running, please start the application.
- If device data have not been downloaded recently, click »Receive Data From The Device« in the *»Device«* menu.
- Double click the »Device parameters« icon in the navigation tree.
- Double click the »Date/time« icon within the operational data.
- From the working window, the User can now synchronize the date and time of the device with the PC (i.e.: that means that the device accepts the date and time from the PC).

Version

Within the*»Device parameters/Version«* menu, the User can obtain information on the software and hardware versions.

Version Via PowerPort-E

Within the *»File/Properties«* menu, the User can obtain detailed information on the currently opened file (e.g.: software and hardware version).

NOTICE

In order to be able to transmit a parameter file (e.g.: created off line) into the device, the following parameters must agree:

- **Type Code (written on the top of the device/type label); and**
- **Version of the device model (can be found in the *»Device Parameters\Version«* menu).**

TCP/IP Settings

Within *»Device Para / TCP/IP«* menu, the TCP/IP settings have to be set.

The first-time setting of the TCP/IP Parameters can be done at the panel (HMI) only.

NOTICE

Establishing a connection via TCP/IP to the device is only possible if the device is equipped with an Ethernet interface (RJ45).

Contact your IT administrator in order to establish the network connection.

Set the TCP/IP Parameters:

Call up *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address;
- Subnetmask; and
- Gateway.

Direct Commands of the System Module

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack LED	All acknowledgeable LEDs will be acknowledged.	Inactive, Active	Inactive	[Operation /Reset]
Ack RO	All acknowledgeable Relay Outputs will be acknowledged.	Inactive, Active	Inactive	[Operation /Reset]
Ack Comm	Communication will be acknowledged.	Inactive, Active	Inactive	[Operation /Reset]
Ack RO LED Comm TCmd	Reset the Relay Outputs, LEDs, Communication, and the Trip Command.	Inactive, Active	Inactive	[Operation /Reset]
Reboot	Rebooting the device.	No, Yes	No	[Service /General]
Maint Mode Manually	Arc Flash Reduction Maintenance Switch Mode: Manual Activation of the Arc Flash Reduction Mode Only available if: Maint Mode = Activation Manually	Maint Mode inactive, Activation via Comm, Activation via DI, Inactive, Active	Inactive	[Service /Maint Mode Manually]

CAUTION

CAUTION, rebooting the device manually will release the Supervision Contact.

Global Protection Parameters of the System

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
PSet-Switch	Switching Parameter Set	PS1, PS2, PS3, PS4, PSS via Inp fct, PSS via Comm	PSS via Inp fct	[Protection Para /PSet-Switch]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
PS1: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]
PS2: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
PS3: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]
PS4: Activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8, Sys.Maint Mode Active, Sys.Maint Mode Inactive	-.-	[Protection Para /PSet-Switch]
Ack LED	All acknowledgeable LEDs will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]

Parameter	*Description*	*Setting Range*	*Default*	*Menu Path*
Ack RO	All acknowledgeable Relay Outputs will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]
Ack Comm	Communication will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]
Scaling	Display of the measured values as primary, secondary, or per unit values	Per unit values, Primary values, Secondary values	Primary values	[Operation /General Settings]
Maint Mode	Activation Mode of the Arc Flash Reduction. Switching into another mode is only possible when no Activation Signal is active (pending).	Inactive, Activation Manually, Activation via Comm, Activation via DI	Activation Manually	[Service /Maint Mode]
Maint Mode Activated by	Activation Signal for the Arc Flash Reduction Maintenance Switch Only available if: Maint Mode Activated by = Activation via DI	-.-, DI-8P X1.DI 1, DI-8P X1.DI 2, DI-8P X1.DI 3, DI-8P X1.DI 4, DI-8P X1.DI 5, DI-8P X1.DI 6, DI-8P X1.DI 7, DI-8P X1.DI 8	DI-8P X1.DI 7	[Service /Maint Mode]

System Module Input States

Name	*Description*	*Assignment Via*
Ack LED-I	Module Input State: LEDs Acknowledgment by Digital Input.	[Device Para /Ex Acknowledge]
Ack RO-I	Module Input State: Acknowledgment of the Relay Outputs.	[Device Para /Ex Acknowledge]
Ack Comm-I	Module Input State: Acknowledge Communication via Digital Input. The replica that Communication has received from the device is to be reset.	[Device Para /Ex Acknowledge]
PS1-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS2-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS3-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS4-I	State of the module input, respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
Maint Mode-I	Module Input State: Arc Flash Reduction Maintenance Switch	[Service /Maint Mode]

System Module Signals

Name	*Description*
Reboot	Signal: Rebooting the device: 1=Restart initiated by power supply; 2=Restart initiated by the user; 3=Set on defaults (Super Reset); 4=Restart by the debugger; 5=Restart because of configuration change; 6=General failure; 7=Restart initiated by System Abort (host side); 8=Restart initiated by watchdog timeout (host side); 9=Restart initiated by System Abort (dsp side); 10=Restart initiated by watchdog timeout (dsp side); 11=Power supply failure (short term interruption) or power supply voltage to low; 12=illegal memory access.
Act Set	Signal: Active Parameter Set
PS 1	Signal: Parameter Set 1
PS 2	Signal: Parameter Set 2
PS 3	Signal: Parameter Set 3
PS 4	Signal: Parameter Set 4
PSS manual	Signal: Manual switch over of a Parameter Set
PSS via Comm	Signal: Parameter Set Switch via Communication
PSS via Inp fct	Signal: Parameter Set Switch via Input Function
Min. 1 param changed	Signal: At least one parameter has been changed
Maint Mode Active	Signal: Arc Flash Reduction Maintenance Active
Maint Mode Inactive	Signal: Arc Flash Reduction Maintenance Inactive
Maint Mode Manually	Signal: Arc Flash Reduction Maintenance Manual Mode
Maint Mode Comm	Signal: Arc Flash Reduction Maintenance Comm Mode
Maint Mode DI	Signal: Arc Flash Reduction Maintenance Digital Input Mode
Param to be saved	Number of parameters to be saved. 0 means that all parameter changes are overtaken.
Ack LED	Signal: LEDs Acknowledgment
Ack RO	Signal: Acknowledgment of the Relay Outputs
Ack Counter	Signal: Reset of all Counters
Ack Comm	Signal: Acknowledge Communication
Ack TripCmd	Signal: Reset Trip Command
Ack LED-HMI	Signal: LEDs Acknowledgment :HMI
Ack RO-HMI	Signal: Acknowledgment of the Relay Outputs :HMI
Ack Counter-HMI	Signal: Reset of all Counters :HMI
Ack Comm-HMI	Signal: Acknowledge Communication :HMI
Ack TripCmd-HMI	Signal: Reset Trip Command :HMI
Ack LED-Comm	Signal: LEDs Acknowledgment :Communication
Ack RO-Comm	Signal: Acknowledgment of the Relay Outputs :Communication
Ack Counter-Comm	Signal: Reset of all Counters :Communication
Ack Comm-Comm	Signal: Acknowledge Communication :Communication

Name	*Description*
Ack TripCmd-Comm	Signal: Reset Trip Command :Communication

Special Values of the System Module

Value	*Description*	*Menu Path*
Build	Build	[Device Para /Version]
Version	Version	[Device Para /Version]
Operating hours Cr	Operating hours counter	[Operation /Count and RevData /Sys]

Commissioning

Before starting work on an open switchboard, it is required that the switchboard is de-energized and the following five safety regulations have been met.

DANGER

Safety precautions:

- **Disconnect the power supply;**
- **Secure against reconnection;**
- **Verify that the equipment is de-energized;**
- **Connect to ground and short-circuit all phases; and**
- **Cover or safeguard all live adjacent parts.**

DANGER

The secondary circuit of a current transformer must never be opened during operation. The prevailing high voltages can cause severe injury or death.

WARNING

Even when the auxiliary voltage is switched off, it is likely that there are still hazardous voltages at the component connections.

All locally applicable national and international installation and safety regulations for working at electrical power installations MUST always to be followed.

WARNING

Prior to the initial voltage connection, the following must be guaranteed:

- **Correct grounding of the device;**
- **That all signal circuits are tested;**
- **That all control circuits are tested;**
- **Transformer wiring is checked;**
- **Correct rating of the CTs;**
- **Correct burden of the CTs;**
- **That the operational conditions are in line with the Technical Data;**
- **Correct rating of the transformer protection;**
- **Function of the transformer fuses;**
- **Correct wiring of all digital inputs;**
- **Polarity and capacity of the supply voltage; and**
- **Correct wiring of the analog inputs and outputs.**

NOTICE

The permissible deviations of measuring values and device adjustment are dependent on the Technical Data/Tolerances.

Commissioning/Protection Test

WARNING **Commissioning/protection test must be carried out by authorized and qualified personnel. Before the device is put into operation, the related documentation MUST be read and understood.**

WARNING **With any test of the protection functions, the following has to be checked:**

- **Is activation/tripping saved in the event recorder?**
- **Is tripping saved in the fault recorder?**
- **Is tripping saved in the disturbance recorder?**
- **Are all signals/messages correctly generated?**
- **Do all generally configured blocking functions work properly?**
- **Do all temporarily configured (via DI) blocking functions work properly?**
- **To enable checks on all LEDs and relay functions, these have to be provided with the relevant pickup (alarm) and tripping functions of the respective protection functions/elements. This MUST be tested in practical operation.**

WARNING **Check of all temporary blockings (via digital inputs).**

- **In order to avoid malfunctions, all blockings related to tripping/non-tripping of protection function MUST be tested. The test can be very complex and should therefore be performed by the same personnel who set up the protection concept.**

CAUTION **Check all general trip blockings. All general trip blockings MUST be tested.**

NOTICE **Prior to the initial operation of the protection device, all tripping times and values shown in the adjustment list MUST be confirmed by a secondary test.**

NOTICE **Any description of functions, parameters, inputs, or outputs that does not match the device in hand can be ignored.**

Decommissioning – Removing the Plug from the Relay

WARNING **Dismounting the relay will lead to a loss of the protection functionality. Ensure that there is a back-up protection. If you are not aware of the consequences of decommissioning the device – STOP! DO NOT start.**

WARNING **Inform SCADA before you start.**

Switch-off the power supply.

Ensure that the cabinet is de-energized and that there are no voltages that could lead to injury of personnel.

Disconnect the terminals at the rear-side of the device. DO NOT pull any cable – pull on the plug! If it is stuck, use a screw driver.

Fasten the cables and terminals in the cabinet by means of cable clips to ensure that no accidental electrical connections are caused.

Hold the device at the front-side while removing the mounting nuts.

Remove the device carefully from the cabinet.

In case no other device is to be mounted or replaced, cover/close the cut-out in the front-door.

Close the cabinet.

Service

Within the service menu various functions support maintenance and commissioning of the device.

General

Within the menu [Service/General], the user can initiate a reboot of the device.

Maintenance Mode

Principle – General Use

NOTICE **The Maintenance Mode can be used to reduce arc flash levels. Refer to Std. NFPA70E.**

DANGER **DO NOT attempt to install or perform maintenance on equipment while it is energized. Severe personal injury or death can result from contact with energized equipment. Verify that no voltage is present before opening doors of the switchboard.**

DANGER **If maintenance will be performed on a device, special protective clothing and equipment MUST BE USED and all industry standard procedures MUST BE FOLLOWED. Failure to do so can result in severe personal injury or death.**

The Maintenance Mode can improve safety by providing a simple and reliable method to reduce fault clearing time and lower incident energy levels at energized panels. The Maintenance Mode allows the User to switch to more sensitive settings via the HMI/panel, Communication, or via a Digital Input while maintenance work is being performed at an energized panel or device. The more sensitive settings provide greater security for maintenance personnel and helps reduce the possibility of injury.

The status of the Maintenance Mode (active/inactive) is stored power fail-safe.

NOTICE **Manual activation is only possible via the HMI/panel (not via PowerPort-E).**

The Maintenance Mode can be activated:

- Manually (only at the HMI/panel);
- Via communication; or
- Via a digital input.

NOTICE **Changing to another mode is only possible if there is no active Activation Signal (e.g.: if the device is in the “Via Digital Input Mode” and while the assigned Digital Input is “true”, the User cannot switch to the “Manual Mode”).**

Before Use

DANGER **The sensitivity settings for the Maintenance Mode have to be calculated and programmed into the device (according to Std. NFPA70E). They are not part of the device by default.**

When the Maintenance Mode is enabled and fault current causes its operation, the fault clearing time of the associated breaker has to be very fast. Calculate the sensitivity setting on the basis of **Std. NFPA70E.**

Program those sensitivity settings either into a setting group or into Adaptive Parameters.

How to Use the Maintenance Mode

Calculate the sensitivity setting on the basis of **Std. NFPA70E.** Program those sensitivity settings either into a setting group or into Adaptive Parameters.

The Maintenance Mode offers two output signals: “Maint Mode activated” and “Maint Mode not activated”.

The »Maint Mode.ACTIVATED« signal should be used to:

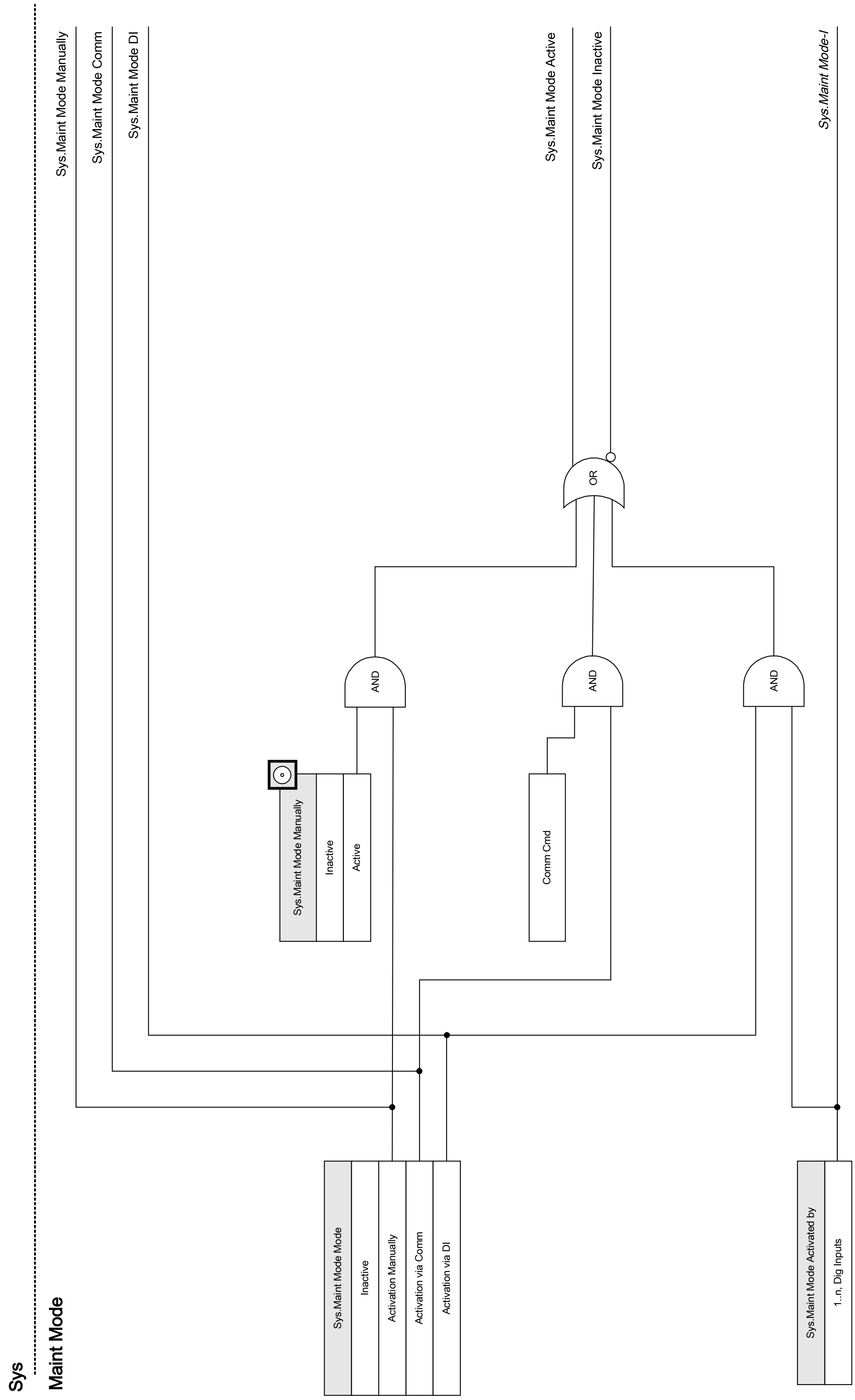
•Switch to another setting group (in case the sensitivity settings are saved within this setting group);
•Activate “Adaptive Parameters” (in case the sensitivity settings are saved within these adaptive parameters); and/or
•Block or activate dedicated functions.

Please see the Adaptive Parameters section for more details.

The »Maint Mode.NOT ACTIVATED« signal should be used to:

•Switch back to the standard setting group when Maintenance Mode should not be used.

For a fast access, the Maintenance Mode can be accessed by means of the »Softkey« Maint on the start screen (root) of the device.


Sys
Maint Mode
Sys.Maint Mode Manually
Sys.Maint Mode Comm
Sys.Maint Mode DI
Sys.Maint Mode Active
Sys.Maint Mode Inactive
Sys.Maint Mode-I
OR
AND
AND
AND
Sys.Maint Mode Manually
Inactive
Active
Comm Cmd
Sys.Maint Mode Mode
Inactive
Activation Manually
Activation via Comm
Activation via DI
Sys.Maint Mode Activated by
1..n, Dig Inputs

Forcing the Relay Output Contacts

NOTICE **The parameters, their defaults, and setting ranges have to be taken from Relay Output Contacts section.**

Principle – General Use

DANGER **The User MUST ENSURE that the relay output contacts operate normally after maintenance is completed. If the relay output contacts do not operate normally, the protective device WILL NOT provide protection.**

For commissioning purposes or for maintenance, relay output contacts can be set by force.

Within this mode [Service/Test/Force RO], relay output contacts can be set by force:

•Permanent; or
•Via timeout.

If they are set with a timeout, they will keep their "Force Position" only as long as this timer runs. If the timer expires, the relay will operate normally. If they are set as Permanent, they will keep the "Force Position" continuously.

There are two options available:

•Forcing a single relay »*Force Rox«;* and
•Forcing an entire group of relay output contacts »*Force all Outs«*.

Forcing an entire group takes precedence over forcing a single relay output contact!

NOTICE **A relay output contact <u>will NOT follow a force command</u> as long as it is disarmed at the same time.**

NOTICE **A relay output contact <u>will follow a force command:</u>**

•If it is not disarmed; and

•If the Direct Command is applied to the relay(s).

Keep in mind, that the forcing of all relay output contacts (of the same assembly group) takes precedence over the force command of a single relay output contact.

Disarming the Relay Output Contacts

NOTICE **The parameters, their defaults, and setting ranges have to be taken from the Relay Output Contacts section.**

Principle – General Use

Within this mode [Service/Test/Disarmed], entire groups of relay output contacts can be disabled. By means of this test mode, contact outputs switching actions of the relay output contacts are prevented. If the relay output contacts are disarmed, maintenance actions can be carried out without the risk of taking entire processes off-line.

DANGER **The User MUST ENSURE that the relay output contacts are ARMED AGAIN after maintenance is complete. If they are not armed, the protective device WILL NOT provide protection.**

NOTICE **Zone Interlocking Output and the Supervision Contact cannot be disarmed.**

Within this mode [Service/Test/DISARMED] entire groups of relay output contacts can be disarmed:

•Permanent; or

•Via timeout.

If they are set with a timeout, they will keep their "Disarm Position" only as long as this timer runs. If the timer expires, the relay output contacts will operate normally. If they are set Permanent, they will keep the "Disarm State" continuously.

NOTICE **A relay output contact <u>will NOT be disarmed as long as</u>:**

•A relay output contact will NOT be disarmed if it´s latched (and not yet reset).

•A relay output contact will NOT be disarmed as long as a running t-OFF-delay timer is not yet expired (hold time of a relay output contact).

•If the Disarm Control is not set to active.

•If the Direct Command is not applied.

NOTICE **A relay output contact <u>will be disarmed</u> if it´s not latched and**

•If there is no running t-OFF-delay timer (hold time of a relay output contact) and

•If the DISARM Control is set to active and

•If the Direct Command Disarm is applied.

Self Supervision

The *System-OK contact (SC relay)* cannot be configured. The system contact is a Form "C" contact that picks up when the device is free from internal faults. While the device is booting up, the *System OK relay (SC)* remains dropped-off (unenergized). As soon as the system is properly started (and protection is active), the System Contact picks up and the assigned LED is activated accordingly (please refer to the Self Supervision chapter).

The devices are continuously monitored and supervised through different methods during normal operation as well as during the start-up phase.

Results of this supervision may be:

- Messages appearing within the event recorder;
- Indications within the display or PowerPort-E;
- Corrective measures;
- Disabling of protection functions;
- Restart of the device; or
- Any combination of the above results.

In case of failures that cannot be corrected immediately, 3 restarts within 20 minutes are accepted before the device will be deactivated. In such a case, the device should be removed for service to ensure continuous correct operation. The Eaton Customer Service contact information and address can be found at the front of this manual.

In case of any failures, the recorders of the device should be left untouched to ensure an easy diagnosis and proper repair at the factory. Besides the records and visible indications to the customer, there is internal information about failures. These allow Eaton service personnel at the repair facility to make a detailed analysis of files with failure reports.

Self supervision is applied by different functions at different cyclic or non-cyclic timings to the following parts and functions of the device:

- Faultless cyclic execution of the software;
- Functional capability of memory boards;
- Consistency of data;
- Functional capability of hardware sub-assemblies; and
- Faultless operation of the measuring unit.

Faultless cyclic operation of the software is supervised by timing analysis and checking results of different functions. Errors of the software function (watchdog function) lead to restarting the device and switching off the self-supervision relay (life contact). In addition, the "System-OK" LED will blink red after 3 unsuccessful attempts to restart the device within a time period of 20 minutes.

The main processor cyclically monitors the operation of the signal processor and initiates corrective actions or restart of the device in case of faulty operation.Data and files are generally secured against unintended overwriting or faulty changes by check-sums.

The measuring unit continuously checks the measured data by comparing received data with data from a second channel sampled in parallel.

Monitoring of the auxiliary voltage is done by reset IC's. If the voltage of one of the different supply circuits falls below a certain threshold, a restart of the device is initiated. There are three major supply groups (24 V, 3.3 V and 1.6 V), each of them being monitored separately and forcing the processor to reset (stop of the device) until the voltage again reaches nominal value. If the voltage staggers around the threshold, the device also starts again after five s.

Independent of these separate monitoring functions, the intermediate voltage circuit is buffered for 100 ms until all important and relevant operational and fault-data have been saved and the device initiates a restart. The device will restart after five (5) seconds.

Error Messages / Codes

After a reboot of the device, the reason for rebooting will be displayed under [Operation/Status Display/Sys/Reset]. For more information about the reboot reason, please refer to the information in this section.

The reboot will also be logged within the event recorder. Rebooting causes an event named “Sys.reboot”.

Numeric Reboot Codes

Error Messages/Codes	
1.	Reboot after clean switching off of the device - Normal reboot after clean shut-down of the device.
2.	Reboot by User command - User-initiated reboot through panel command.
3.	Super reset - Reset to factory settings.
4.	Restart by debugger - Eaton internally for system-analysis purposes.
5.	Restart because of configuration changes.
6.	General failure - Reboot without definite reason.
7.	Reboot by “SW-system abort” (HOST-side) - Summary of several reboot reasons detected by the software (i.e.: wrong pointer, corrupted files, etc.).
8.	Reboot by watchdog timeout (HOST-side) - Signaling if the protection-class-task hangs for more than 800 ms.
9.	Reboot by system abort (DSP-side) - Summary of several reboot reasons detected by software (i.e.: wrong pointer, DSP-side).
10.	Reboot by watchdog timeout (DS-side) - Appears when DSP sequence needs longer than 3 ms for one cycle.
11.	Loss of auxiliary voltage or low voltage reboot after loss of auxiliary voltage or voltage dropping below reboot level but not becoming zero.
12.	Faulty memory access - Message of MMU (memory mapping unit) that prohibited memory access has occurred.

Technical Data

NOTICE **Use Copper conductors only, 75°C (167°F). Conductor size AWG 14 [2.5 mm].**

Climatic Environmental Conditions

Storage Temperature:	-30°C to +70°C (-22°F to 158°F)
Operating Temperature:	-20°C to +60°C (-4°F to 140°F)
Permissible Humidity at Ann. Average:	<75% rel. (on 56d up to 95% rel.)
Permissible Installation Altitude:	<2,000 m (6,561.67 ft) above sea level If 4,000 m (13,123.35 ft) altitude applies, a changed classification of the operating and test voltages may be necessary.

Degree of Protection EN 60529

HMI Front Panel with Seal:	IP54
Rear Side Terminals:	IP20

Routine Test

Insulation Test Acc. to IEC60255-5:	All tests to be carried out against ground and other input and output circuits.
Aux. Voltage Supply, Digital Inputs, Current Measuring Inputs, Signal Relay Outputs:	2.5 kV (eff.) / 50 Hz
Voltage Measuring Inputs:	3.0 kV (eff.) / 50 Hz
All Wire-Bound Communication Interfaces:	1.5 kV DC

Housing

Housing B2: Height / Width	183 mm (7.205 in.)/ 212.7 mm (8.374 in.)
Housing Depth (Incl. Terminals):	208 mm (8.189 in.)
Material, Housing:	Aluminum extruded section
Material, Front Panel:	Aluminum/Foil front
Mounting Position:	Horizontal (±45° around the X-axis must be permitted)
Weight:	Approx. 4.2 kg (9.259 lb)

Current and Ground Current Measurement

Nominal Currents:	1 A / 5 A
Max. Measuring Range:	Up to 40 x In (phase currents) Up to 25 x In (ground current standard) Up to 2.5 x In (ground current sensitive)
Continuous Loading Capacity:	4 x In/continuously
Overcurrent Proof:	30 x In / 10 s 100 x In / 1 s 250 x In / 10 ms (1 half-wave)
Power Consumption:	Phase current inputs At In = 1A S = 0.15 mVA At In = 5A S = 0.15 mVA Ground current input At In = 1A S = 0.35 mVA At In = 5A S = 0.35 mVA
Frequency Range:	50 Hz / 60 Hz ±10%
Terminals:	Screw-type terminals with integrated short-circuiters (contacts)
Connection Cross Sections:	1 x or 2 x 2.5 mm² (2 x AWG 14) with wire end ferrule 1 x or 2 x 4.0 mm² (2 x AWG 12) with ring cable sleeve or cable sleeve 1 x or 2 x 6 mm² (2 x AWG 10) with ring cable sleeve or cable sleeve The current measuring board´s terminal blocks may be used as with 2 (double) conductors AWG 10,12,14 otherwise with single conductors only.

Plug-in Connector with Integrated Short-Circuiter (Conventional Current Inputs)

Nominal Current:	1 A and 5 A
Continuous Loading Capacity:	4 x In / continuously
Overcurrent Withstand:	30 x In / 10 s 100 x In / 1 s 250 x In / 10 ms (1 half-wave)
Screws:	M4, captive type acc. to VDEW
Connection Cross Sections:	1 x or 2 x 2.5 mm² (2 x AWG 14) with wire end ferrule 1 x or 2 x 4.0 mm² (2 x AWG 12) with ring cable sleeve or cable sleeve 1 x or 2 x 6 mm² (2 x AWG 10) with ring cable sleeve or cable sleeve The current measuring board´s terminal blocks may be used as with 2 (double) conductors AWG 10,12,14 otherwise with single conductors only.

Voltage and Residual Voltage Measurement

Nominal Voltages:	100 V/ 110 V/ 230 V/ 400 V (can be configured)
Max. Measuring Range:	2 x nominal voltage
Continuous Loading Capacity:	2 x nominal voltage (800 Vac)
Power Consumption:	at Vn = 100 V S = 0.1 mVA
	at Vn = 110 V S = 0.1 mVA
	at Vn = 230 V S = 0.4 mVA
	at Vn = 400 V S = 1.0 mVA
Frequency Range:	50 Hz or 60 Hz ±10%
Terminals:	Screw-type terminals

Frequency Measurement

Nominal Frequencies:	50 Hz / 60 Hz

Voltage Supply

Aux. Voltage:	24 - 270 Vdc / 48 - 230 Vac (-20/+10%)
Buffer Time in Case of Supply Failure:	>= 50 ms at minimal aux. voltage Interrupted communication is permitted.
Max. Permissible Making Current:	18 A peak value for <0.25 ms 12 A peak value for <1 ms

The voltage supply must be protected by a fuse of:

- 2,5 A time-lag miniature fuse 5 x 20 mm (approx. 0.2 x 0.8 in.) according to IEC 60127
- 3,5 A time-lag miniature fuse 6,3 x 32 mm (approx. 0.25 x 1.25 in.) according to UL 248-14

Power Consumption

Power Supply Range:	Power consumption in Idle Mode	Max. Power Consumption
24 - 270 Vdc:	Approx. 7 W	Approx.13 W
48 - 230 Vac (For Frequencies of 40-70 Hz):	Approx. 7 VA	Approx.13 VA

Display

Display Type:	LCD with LED background illumination
Resolution - Graphics Display:	128 x 64 pixel
LED - Type:	Two colored: red / green
Number of LEDs, Housing B2:	15

Front Interface RS232

Baud Rates:	115,200 Baud
Handshake:	RTS and CTS
Connection:	9-pole D-Sub plug

Real Time Clock

Running Reserve of the Real Time Clock:	1 year min.

Digital Inputs

Max. Input Voltage:	300 Vdc / 259 Vac
Input Current:	<4 mA
Reaction Time:	<20 ms
Fallback Time:	<30 ms

(Safe State of the Digital Inputs)

Switching Thresholds:	Un = 24 Vdc, 48 Vdc, 60 Vdc, 110 Vac / dc, 230 Vac / dc
Un = 24 Vdc	
Switching Threshold 1 ON:	Min. 19.2 Vdc
Switching Threshold 1 OFF:	Max. 9.6 Vdc
Un = 48 V / 60Vdc	
Switching Threshold 2 ON:	Min. 42.6 Vdc
Switching Threshold 2 OFF:	Max. 21.3 Vdc
Un = 110 / 120 Vac / dc	
Switching Threshold 3 ON:	Min. 88.0 Vdc / 88.0 Vac
Switching Threshold 3 OFF:	Max. 44.0 Vdc / 44.0 Vac
Un = 230 / 240 Vac / dc	
Switching Threshold 4 ON:	Min. 184 Vdc / 184 Vac
Switching Threshold 4 OFF:	Max. 92 Vdc / 92 Vac
Terminals:	Screw-type terminal

Relay Outputs

Continuous Current:	5 A ac / dc
Max. Make Current:	25 A ac / 25 A dc up to 30 V for 4 s
	30 A / 230Vac according to ANSI IEEE Std C37.90-2005
	30 A / 250Vdc according to ANSI IEEE Std C37.90-2005
Max. Breaking Current:	5 A ac up to 120/240 Vac
	5 A dc up to 30 V (resistive)
	0.3 A dc at 300 V
Max. Switching Voltage:	250 V ac / 250 Vdc
Switching Capacity:	1,250 VA
Contact Type:	Form C or normally open contact
Terminals:	Screw-type terminals

Supervision Contact (SC)

Continuous Current:	5 A ac / dc
Max. Switch-on Current:	15 A ac / 15 A dc up to 30 V for 4 s
Max. Breaking Current:	5 A ac up to 250 Vac
	5 A dc up to 30 Vdc
	0,4 A at 125 Vdc
Contact Type:	1 Form C contact
Terminals:	Screw-type terminals

Time Synchronization IRIG-B00X

Nominal input voltage:	5 V
Connection:	Screw-type terminals (twisted pair)

Zone Interlocking

Only for Zone Interlock Tripping Outputs (Zone Interlock, semiconductor output): 5 Vdc, <2mA for connection to electronic inputs only.

Zone Out:	
Output voltage (High)	4.75 to 5.25 Vdc
Output voltage (Low)	0.0 to +0.5 Vdc
Zone In:	
Nominal input voltage	+5 Vdc
Max. input voltage	+5.5 Vdc
Switching threshold ON	min. 4.0 Vdc
Switching threshold OFF	max. 1.5 Vdc
Galvanic isolation	2.5 kV ac (to ground and other IO)
Connection:	Screw-type terminals (twisted pair)

RS485*

Master/Slave:	Slave
Connection:	6 screw-clamping terminals RM 3.5 mm (138 MIL) (terminating resistors internal)

CAUTION **The RS485 interface is realized via terminals. The communication cable has to be shielded. The shielding has to be fixed at the screw that is marked with the ground symbol (rear side of the device).**

*availability depends on device

Boot Phase

After switching on the power supply, the protection will be available in approximately 46 seconds. After approximately 97 seconds, the boot phase is completed (HMI and Communication initialized).

Standards

Approvals

- UL-listed file: e217753

Design Standards

Generic Standard	EN 61000-6-2 EN 61000-6-3
Product Standard	IEC 60255-6 EN 50178 UL 508 (Industrial Control Equipment) CSA C22.2 No. 14-95 (Industrial Control Equipment) ANSI C37.90

High Voltage Tests (IEC 60255-6)

High Frequency Interference Test		
IEC 60255-22-1 Class 3	Within one circuit	1 kV/2 s
	Circuit to ground	2.5 kV/2 s
	Circuit to circuit	2.5 kV/2 s
Insulation Voltage Test		
IEC 60255-5 EN 50178	All circuits to other circuits and exposed conductive parts	2.5 kV (eff.)/50Hz, 1 min.
	Except interfaces	1.5 kV DC, 1 min.
	Voltage measuring input	3 kV (eff.)/50 Hz, 1 min.
Impulse Voltage Test		
IEC 60255-5		5 kV/0.5J, 1.2/50 µs

EMC Immunity Tests

Fast Transient Disturbance Immunity Test (Burst)		
IEC 60255-22-4 IEC 61000-4-4 Class 4 ANSI C37.90.1	Power supply, mains inputs	±4 kV, 2.5 kHz
	Other in- and outputs	±2 kV, 5 kHz (coupling network) ±4 kV, 2.5 kHz (coupling clamp)
Surge Immunity Test		
IEC 61000-4-5 Class 4	Within one circuit	2 kV
	Circuit to ground	4 kV
Class 3	Communication cables	2 kV

Electrical Discharge Immunity Test

IEC 60255-22-2 IEC 61000-4-2 Class 3	Air discharge	8 kV
	Contact discharge	6 kV

Radiated Radio Frequency Electromagnetic Field Immunity Test

IEC 61000-4-3	26 MHz – 80 MHz	10 V/m
Class X	80 MHz – 1 GHz	35 V/m
ANSI C37.90.2	1 GHz – 3 GHz	10 V/m

Immunity to Conducted Disturbances Induced by Radio Frequency Fields

IEC 61000-4-6 Class 3		10 V

Power Frequency Magnetic Field Immunity Test

IEC 61000-4-8 Class 4	Continuous	30 A/m
	3 sec	300 A/m

EMC Emission Tests

Radio Interference Suppression Test

IEC/CISPR11		Limit value class B

Radio Interference Radiation Test

IEC/CISPR11		Limit value class B

Environmental Tests

Classification:		
IEC 60068-1	Climatic Classification	0/055/56
IEC 60721-3-1	Classification of ambient conditions (Storage)	1K5/1B1/1C1L/1S1/1M2 but min. -25°C (-13°F)
IEC 60721-3-2	Classification of ambient conditions (Transportation)	2K3/2B1/2C1/2S1/2M2
IEC 60721-3-3	Classification of ambient conditions (Stationary use at weather protected locations)	3K6/3B1/3C1/3S1/3M2 but min. 0°C (32°F) and 3K8H for 2 h
Test Ad: Cold		
IEC 60068-2-1	Temperature	-20°C (-4°F)
	Test duration	16 h
Test Bd: Dry Heat		
IEC 60068-2-2	Temperature	55°C (131°F)
	Relative humidity	<50%
	Test duration	72 h
Test Cab: Damp Heat (Steady State)		
IEC 60068-2-78	Temperature	40°C (104°F)
	Relative humidity	93%
	Test duration	56 d
Test Db: Damp Heat (Cyclic)		
IEC 60068-2-30	Temperature	55°C (131°F)
	Relative humidity	95%
	Cycles (12 + 12-hour)	2

Mechanical Tests

Test Fc: Vibration Response Test		
IEC 60068-2-6 IEC 60255-21-1 Class 1	(10 Hz – 59 Hz) Displacement	0.0014 in. (0.035 mm)
	(59Hz – 150Hz) Acceleration	0.5 gn
	Number of cycles in each axis	1
Test Fc: Vibration Endurance Test		
IEC 60068-2-6 IEC 60255-21-1 Class 1	(10 Hz – 150 Hz) Acceleration	1.0 gn
	Number of cycles in each axis	20
Test Ea: Shock Test		
IEC 60068-2-27 IEC 60255-21-2 Class 1	Shock response test	5 gn, 11 ms, 3 impulses in each direction
	Shock resistance test	15 gn, 11 ms, 3 impulses in each direction
Test Eb: Shock Endurance Test		
IEC 60068-2-29 IEC 60255-21-2 Class 1	Shock endurance test	10 gn, 16 ms, 1,000 impulses in each direction
Test Fe: Earthquake Test		
IEC 60068-3-3 KTA 3503 IEC 60255-21-3 Class 2	Single axis earthquake vibration test	3 – 7 Hz: Horizontal 0.394 in. (10 mm), 1 cycle each axis
		7 – 35 Hz Horizontal: 2 gn, 1 cycle each axis

Specifications

Specifications of the Real Time Clock

Resolution:	1 ms
Tolerance:	<1 minute / month (+20°C [68°F])

Specifications of the Measured Value Acquisition

Phase and Ground Current Measuring

Max. Measuring Range:	Up to 40 x In (phase currents) Up to 25 x In (ground current standard)
Frequency Range:	50 Hz / 60 Hz ± 10%
Accuracy:	Class 0.5
Amplitude Error if I < In:	±0.5% of the rated value
Amplitude Error if I > In:	±0.5% of the measured value
Amplitude Error if I > 2 In:	±1.0% of the measured value
Resolution:	0.01 A
Harmonics:	Up to 20% 3rd harmonic ±2% Up to 20% 5th harmonic ±2%
Frequency Influence:	<±2% / Hz in the range of ±5 Hz of the configured nominal frequency
Temperature Influence:	<±1% within the range of 0°C to +60°C (+32°F to +140°F)

Phase-to-ground and Residual Voltage Measurement

Nominal voltage (Vn):	100 V / 110 V / 230 V / 400 V (configurable)
Max measuring range:	2 x nominal value (Vn)
Frequency range:	50 Hz or 60 Hz ±10%
Precision:	Class 0,5
Amplitude error for V<Vn:	±0.5% (of the nominal value)
Amplitude error for V>Vn:	±0.5% (of the nominal value)
Resolution:	0.1 V
Harmonics:	up to 20% 3rd harmonic ±1%, up to 20% 5th harmonic ±1%
Frequency influence:	< ±2% / Hz in the range of ±5 Hz of the configured nominal frequency
Temperature influence:	<±1% within the range of 0°C up to +55°C

Frequency measurement

Nominal frequency:	50 Hz / 60 Hz
Precision:	±0.05% of fn within the range of 40-70 Hz
Voltage dependency:	frequency acquisition of 5 V – 800 V

Protection Elements Accuracy

NOTICE **The tripping delay relates to the time between alarm and trip. The accuracy of the operating time relates to the time between when the measured value has exceeded the threshold until the protection element is picked-up.**

Overcurrent Protection Elements: 50P[x], 51P[x]	*Accuracy*
Pickup	±1.5% of the setting value resp. 1% x In.
Dropout Ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from I higher than 1.1 x I>	<35 ms
Disengaging Time	<45 ms
t-Multiplier	±5% IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t
Reset Mode	±1% resp. ±10 ms IEC NINV IEC VINV IEC EINV IEC LINV
	5% ANSI MINV ANSI VINV ANSI EINV Flat It I2t I4t

Voltage restraint 51V[x]	*Accuracy*
Pickup	±1.5% of the setting value resp. 1% x In.
Dropout Ratio	97% or 0.5% x In
Operating Time Starting from I higher than 1.1 x I>	<35 ms
Disengaging Time	<45 ms
t-Multiplier	±5% IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t
Reset Mode	±1% resp. ±10 ms IEC NINV IEC VINV IEC EINV IEC LINV
	5% ANSI MINV ANSI VINV ANSI EINV Flat It I2t I4t

Ground Current Elements: 50X[x], 50R[x], 51X[x], 51R[x]	*Accuracy*
Pickup	±1.5% of the setting value Resp. 1% x In
Dropout Ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from IE higher than 1.1 x IE>	<35 ms
Disengaging Time	<45 ms
t-Multiplier	±5% IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t
Reset Mode	±1% resp. ±10 ms IEC characteristics IEC NINV IEC VINV IEC EINV IEC LINV
	5% Reset curves if ANSI characteristics ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t

Phase under- and phase overvoltage 27M[x]/59M[x]	*Accuracy*
Pickup	±1.5% of the setting value Resp. 1% x Vn
Dropout Ratio	97% or 0.5% x Vn
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from V higher/lower than 1.1 x V> or V<	<35 ms
Disengaging Time	<45 ms

Aux. under- and phase overvoltage and neutral overvoltage 27A[x]/59A[x]/59N[x]	*Accuracy*
Pickup	±1.5% of the setting value Resp. 1% x Vn
Dropout Ratio	97% or 0.5% x Vn
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from V_G or V_X higher than 1.1 x $V_{G>}$ or $V_{X>}$	<35 ms
Disengaging Time	<45 ms

Current unbalance: 46[x]	*Accuracy*
Threshold	±2% of the setting value resp.1% In
I2/I1 ≥ 0.1 x In	±1%
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from I2/I1 ≥ 1.1 x In	<60 ms
Release Time	<40 ms

Voltage unbalance: 47[x]	*Accuracy*
Threshold	±2% of the setting value resp.1% Vn
V2/V1 ≥ 0.1 x Vn	±1%
t	DEFT ±1% resp. ±10 ms
Operating Time Starting from V2/V1 ≥ 1.1 x Vn	<60 ms
Release Time	<40 ms

Frequency Protection 81O[x]	*Accuracy*
Threshold	10 mHz at fn
Dropout ratio	99.95% or 0.05% x fn
t	±1% resp. ±10 ms
Operating time Starting from f higher than f>+0.02 Hz	40-50Hz <60 ms 50-70Hz <50 ms
Release time	40-50Hz <85 ms 50-70Hz <75 ms
Frequency Protection 81U[x]	*Accuracy*
Threshold	10 mHz at fn
t	±1% resp. ±10 ms
Dropout ratio	100.05% or 0.05% x fn
Operating time Starting from f lower than f<-0.02 Hz	40-50Hz <60 ms 50-70Hz <50 ms
Release time	40-50Hz <85 ms 50-70Hz <75 ms
V Block f	±1.5% of the setting value resp. 1% x Vn
Dropout ratio	103% or 0.5% x Vn

Rate of Change of Frequency df/dt	*Accuracy*
Treshold	100 mHz per Second
t	±1% resp. ±10 ms
Operating time	<40 ms
Release time	<40 ms

Rate of Change of Frequency Df/Dt	*Accuracy*
Treshold	100 mHz per Second
t	±1% resp. ±10 ms
Operating time	<40 ms
Release time	<40 ms

Vector surge 87V	*Accuracy*
Treshold	±0,5° [1-30°] at Vn and fn
Operating time	<40 ms

PF-55D/PF-55A - Power Factor	*Accuracy*
Treshold	± 0.01 (absolute)
Operating time	<120 ms

SOTF – Switch onto fault	*Accuracy*
Operating time	<35 ms
I<	±1.5% of the setting value resp.1% x In
t-enable	±1% resp. ±10 ms

CLPU – Cold load pickup	*Accuracy*
Operating time	<35 ms
t-Load OFF	±1% resp. ±10 ms
t-Max Block	±1% resp. ±10 ms
I<	±1.5% of the setting value resp.1% x In

Breaker Failure Protection 50BF	*Accuracy*
I-BF>	±1.5% of the setting value resp.1% x In
t-BF	±1% resp. ±10 ms
Operating Time Starting from I Higher than 1.3 x I-BF>	<40 ms
Disengaging Time	<40 ms

Trip Circuit Monitoring TCM	*Accuracy*
t-TCM	±1% resp. ±10 ms

LOP - loss of potential	*Accuracy*
t-Pickup	±1% resp. ±10 ms

Current Transformer Supervision CTS	*Accuracy*
ΔI	±2% of the setting value resp. 1.5% In
Dropout Ratio	94%
Pickup delay	±1% resp. ± 10 ms

Appendix

The following terms, abbreviations, and acronyms are used in this manual. Please refer to this section for their meanings / definitions.

A	Ampere(s), Amp(s)
AC	Alternating current
A/D	Analog to digital
Ack.	Acknowledge
AMP	Ampere(s), Amp(s)
AND	Logical gate (The output becomes true if all Input signals are true.)
ANG	Angle
ANSI	American National Standards Institute
AR	Automatic reclosure
AUX	Auxiliary
AVG, avg	Average
AWG	American wire gauge
BF	Breaker failure
BFI	Breaker failure initiate
BKR, bkr	Breaker
Blo	Blocking(s)
°C	Degrees Celsius
calc	Calculated
CB	Circuit breaker
CD	Compact disk
Char	Curve shape
CHK	Check
CHNL	Channel
Cmd.	Command
CMND	Command
CMN	Common input
COM	Common input
Comm	Communication
COMP	Compensated, comparison
CONN	Connection
CONT	Continuous, contact
CPU	Central processing unit
Cr.	Counter(s)
CRT, CRNT	Current
CSA	Canadian Standards Association
CT	Control transformer
Ctrl.	Control
CTS	Current transformer supervision
d	Day
D/A	Digital to analog
D-Sub-Plug	Communication interface
DC, dc	Direct current
DEFT	Definite time characteristic (Tripping time does not depend on the height of the current.)
DFLT	Default
DGNST	Diagnostics
DI	Digital Input
Diagn.	Diagnosis

Diagn Cr	Diagnosis counter(s)
DIFF	Differential
DIN	Deutsche Industrie Norm
DIR, dir	Directional
DMD	Demand
DPO	Dropout
DSP	Digital signal processor
dt	Rate of change
EINV	Extremely inverse tripping characteristic
EMC	Electromagnetic compatibility
EN	Europäische Norm
err. / Err.	Error
EVTcon	Parameter determines if the residual voltage is measured or calculated.
Ex	External
ExBlo	External blocking(s)
ExP	External protection
EXT	Extension, external
°F	Degrees Fahrenheit
F	Field
Fc	Function (Enable or disable functionality = allow or disallow.)
FIFO	First in first out
FIFO Principal	First in first out
FLA	Full load current
FO	Fiber optic
FTP	File transfer protocol
fund	Fundamental (ground wave)
FWD	Forward
G, g	Generator
gn	Acceleration of the earth in vertical direction (9.81 m/s^2)
GND	Ground
GPS	Global positioning system
h	Hour
HARM	Harmonic / harmonics
HMI	Human machine interface (Front of the protective relay)
HTL	Manufacturer internal product designation
HTTP	Hyper text transfer protocol
Hz	Hertz
I	Fault current
I	Current
I0	Zero current (symmetrical components), Zero sequence current
I1	Positive sequence current (symmetrical components)
I2	Negative sequence current (symmetrical components)
IA	Phase A current
IAB	Phase A minus B current
IB	Phase B current
IBC	Phase B minus C current
I-BF	Tripping threshold
IC	Phase C current
IC's	Manufacturer internal product designation
ICA	Phase C minus A current
ID	Identification
IEC	International Electrotechnical Commission
IED	Intelligent electronic device

IEEE	Institute of Electrical and Electronics Engineers
IG	Ground current (not residual)
IG	Fault current
Igd	Differential ground current
IGnom	Nominal ground current
IH1	Fundamental harmonic (1st harmonic)
IH2	2nd harmonic
IINV	Inverse
in.	Inch
incl.	Include, including
Info.	Information
Interl.	Interlocking
INV	Inverse characteristic (The tripping time will be calculated depending on the height of the current)
I/O	Input / output
IOC	Instantaneous overcurrent
IOV	Instantaneous overvoltage
IR	Calculated ground current
IRIG	Input for time synchronization (Clock), Inter-range instrumentation group
ISO	International Standards Organization
IT	Thermal Characteristic
I2T	Thermal Characteristic
I4T	Thermal Characteristic
IUV	Instantaneous undervoltage
IX	4th measuring input of the current measuring assembly group (either ground or neutral current)
J	Joule
kA	Kiloampere
kg	Kilogram
kHz	Kilohertz
kV	Kilovolt(s)
kVdc or kVDC	Kilovolt(s) direct current
L1	Phase A
L2	Phase B
L3	Phase C
I/In	Ratio of current to nominal current.
LED	Light emitting diode
lb-in	Pound-inch
LINV	Long time inverse tripping characteristic
LV	Low voltage
m	Meter
M	Machine
mA	Milliampere(s), Milliamp(s)
MAG	Magnitude
MAN, man.	Manual / manually
MAX, max.	Maximum
meas	Measured
MIN, min.	Minimum
min.	Minute
MINV	Moderately Inverse Tripping Characteristic
MK	Manufacturer Internal Product Designation Code
mm	Millimeter
MMU	Memory mapping unit
MRT	Minimum response time

ms	Milli-second(s)
MTA	Maximum torque angle
MTR	Motor
MV	Medium voltage
mVA	Milli volt amperes (Power)
MVA	Mega volt-ampere (total 3-phase)
MVA A	Mega volt-ampere (phase A)
MVA B	Mega volt-ampere (phase B)
MVA C	Mega volt-ampere (phase C)
MVAR	Mega Var (total 3-phase)
MVAR A	Mega Var (phase A)
MVAR B	Mega Var (phase B)
MVAR C	Mega Var (phase C)
MVARH	Mega Var-Hour
MW	Megawatt(s) (total 3-phase)
MW A	Megawatt(s) (phase A)
MW B	Megawatt(s) (phase B)
MW C	Megawatt(s) (phase C)
MWH	Megawatt-Hour(s)
N	Neutral
N/A, n/a	Not applicable
N.C.	Not connected
NEG	Negative
NINV	Normal inverse tripping characteristic
Nm	Newton-meter
No	Number
N.O.	Normal open (Contact)
NOM, Nom.	Nominal
NT	Manufacturer internal product designation code
O	Over
OC, O/C	Overcurrent
O/P, Op, OUT	Output
OV	Overvoltage
OVERFREQ	Overfrequency
OVLD	Overload
P	Phase
Para.	Parameter
PC	Personal computer
PCB	Printed circuit board
PE	Protected Earth
PF	Power factor (total 3-phase)
PF A	Power factor (phase A)
PF B	Power factor (phase B)
PF C	Power factor (phase C)
Ph	Phase
POS	Positive
PRESS	Pressure
PRI, pri	Primary
PROT, Prot	Protection Module (Master Module), protection
PS1	Parameter set 1
PS2	Parameter set 2
PS3	Parameter set 3
PS4	Parameter set 4

PSet	Parameter set
PSS	Parameter set switch (Switching from one parameter set to another)
pu	Per unit
PWM	Pulse width modulated
PWR	Power
R	Reset
rec.	Record
REF	Reference
rel	Relative
REM	Remote
res	Reset
ResetFct	Reset function
REV	Reverse
RevData	Review data
RMS	Root mean square
RO	Relay Output
RO1	1st Relay Output
RO2	2nd Relay Output
RO3	3rd Relay Output
Rst	Reset
RTD	Resistance-temperature detector
RX (Rx)	Receive, receiver
s	Second
S	Sensitive
SAT	CT saturation
SC	Supervision contact
Sca	SCADA
SCADA	Communication module, supervisory control and data acquistion
sec	Second(s)
SEC, sec	Secondary
SENS	Sensitive
SEQ	Sequence
Sig.	Signal
SNTP	Simple network time protocol
SRC	Source
StartFct	Start function
STATS	Statistics
Sum	Summation
SUPERV	Supervision
SW	Software
SYNC	Synchrocheck
SYNCHCHK	Synchrocheck
Sys.	System
t or t.	Time
t	Tripping delay
T	Time, transformer
Tcmd	Trip command
TCP	Transmission control protocol
TCP/IP	Communication protocol
TEMP, temp	Temperature
THD	Total harmonic distortion
TI	Manufacturer internal product designation code
TOC	Time overcurrent

TOV	Time overvoltage
TRANS	Transient
TripCmd	Trip command
TX (Tx)	Transmit, transmitter
txt	Text
UC	Undercurrent
UL	Underwriters Laboratories
UMZ	DEFT (definite time tripping characteristic)
URTD	Universal resistance-temperature detector
USB	Universal serial bus
V	Volts
V0	Zero sequence voltage
V1	Positive sequence voltage
V2	Negative sequence voltage
VA	Phase A voltage
VAB	Phase A to B voltage
Vac / V ac	Volts alternating current
VAG	Phase A to ground voltage
VARH	Var-hour voltage
VB	Phase B voltage
VBA	Phase B to A voltage
VBG	Phase B to ground voltage
VC	Phase C voltage
VCA	Phase C to A voltage
VCG	Phase C to ground voltage
Vdc / V dc	Volts direct current
VDE	Verband Deutscher Elektrotechnik
VDEW	Verband der Elektrizitätswirtschaft
VE	Residual voltage
V/Hz	Volts per Hertz
VINV	Very inverse tripping characteristic
VT	Voltage transformer
VTS	Voltage transformer supervision
W	Watt(s)
WDC	Watch dog contact (supervision contact)
WDG	Winding
WH	Watthour
www	World wide web
X	Reactance
XCT	4th current measuring input (ground or neutral current)
XInv	Inverse characteristic
Z	Impedance, zone

Instantaneous Current Curves (Phase)

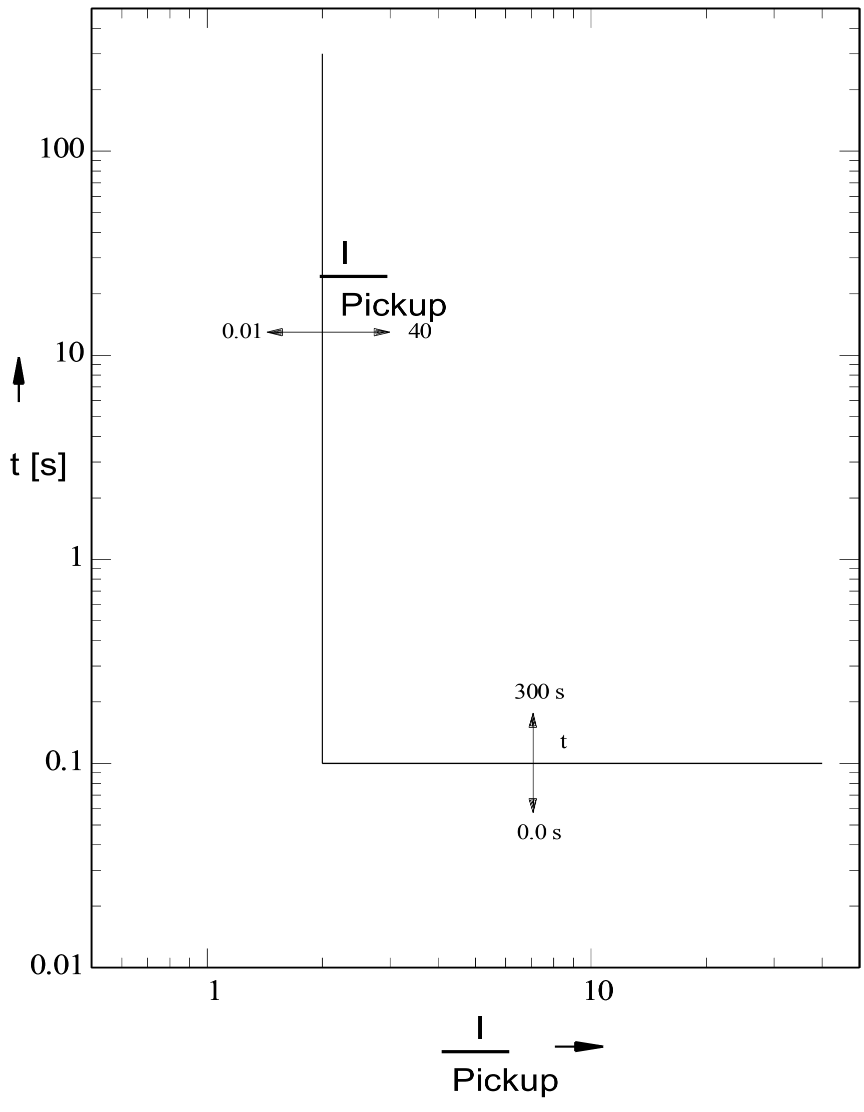
Explanation:

t = Tripping delay

I = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

DEFT



Time Current Curves (PHASE)

The following characteristics are available:

- NINV (IEC/XInv);
- VINV (IEC/XInv);
- LINV (IEC/XInv);
- EINV (IEC/XInv);
- MINV (ANSI/XInv);
- VINV (ANSI/XInv);
- EINV (ANSI/XInv);
- Thermal Flat;
- Therm Flat IT;
- Therm Flat I2T; and
- Therm Flat I4T.

Explanation:

t = Tripping delay

t-multiplier = Time multiplier/tripping characteristic factor

I = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

IEC NINV

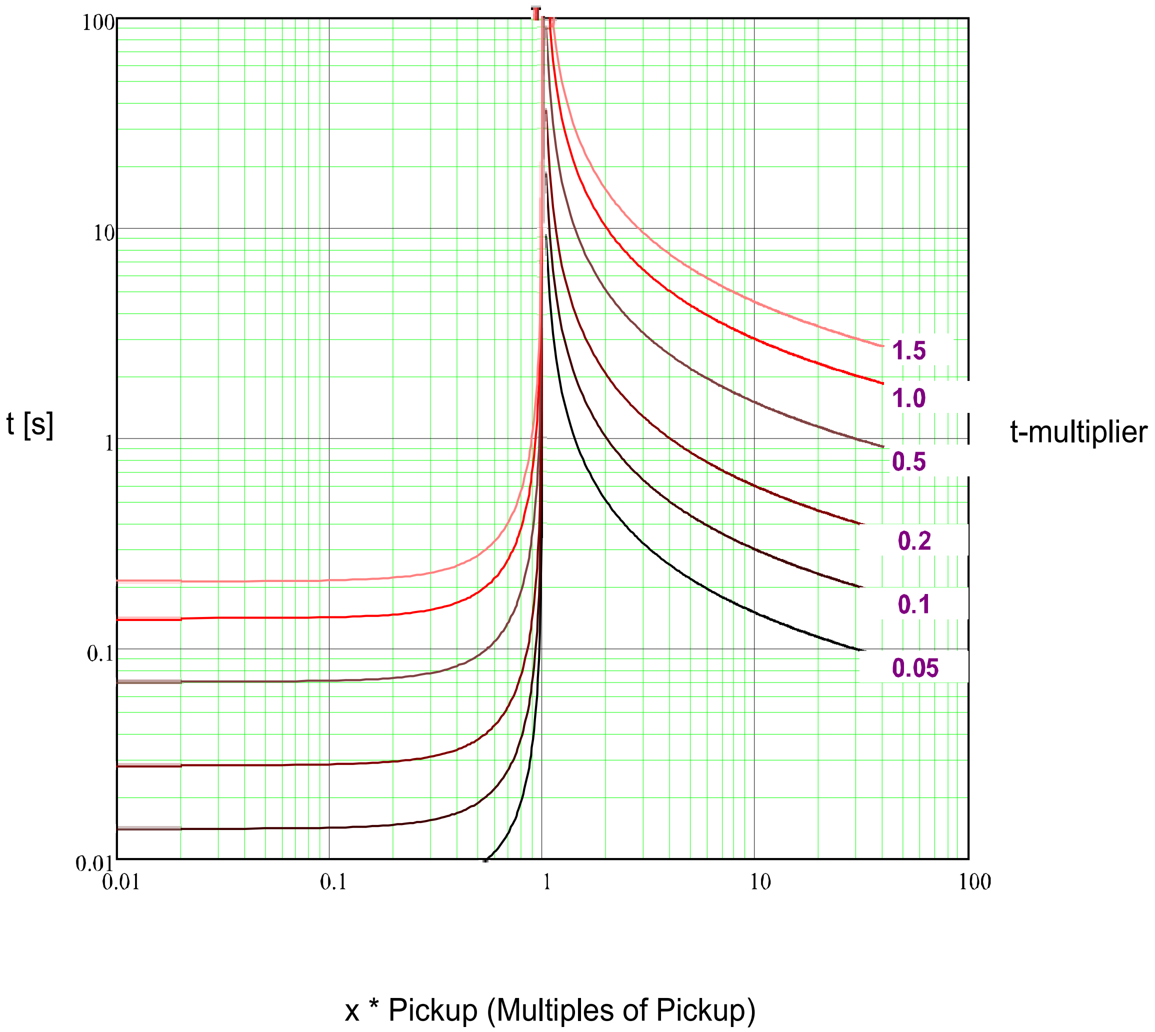
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{I}{Pickup}\right)^{2} - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{0.14}{\left(\frac{I}{Pickup}\right)^{0.02} - 1} \text{*t-multiplier [s]}$$



IEC VINV

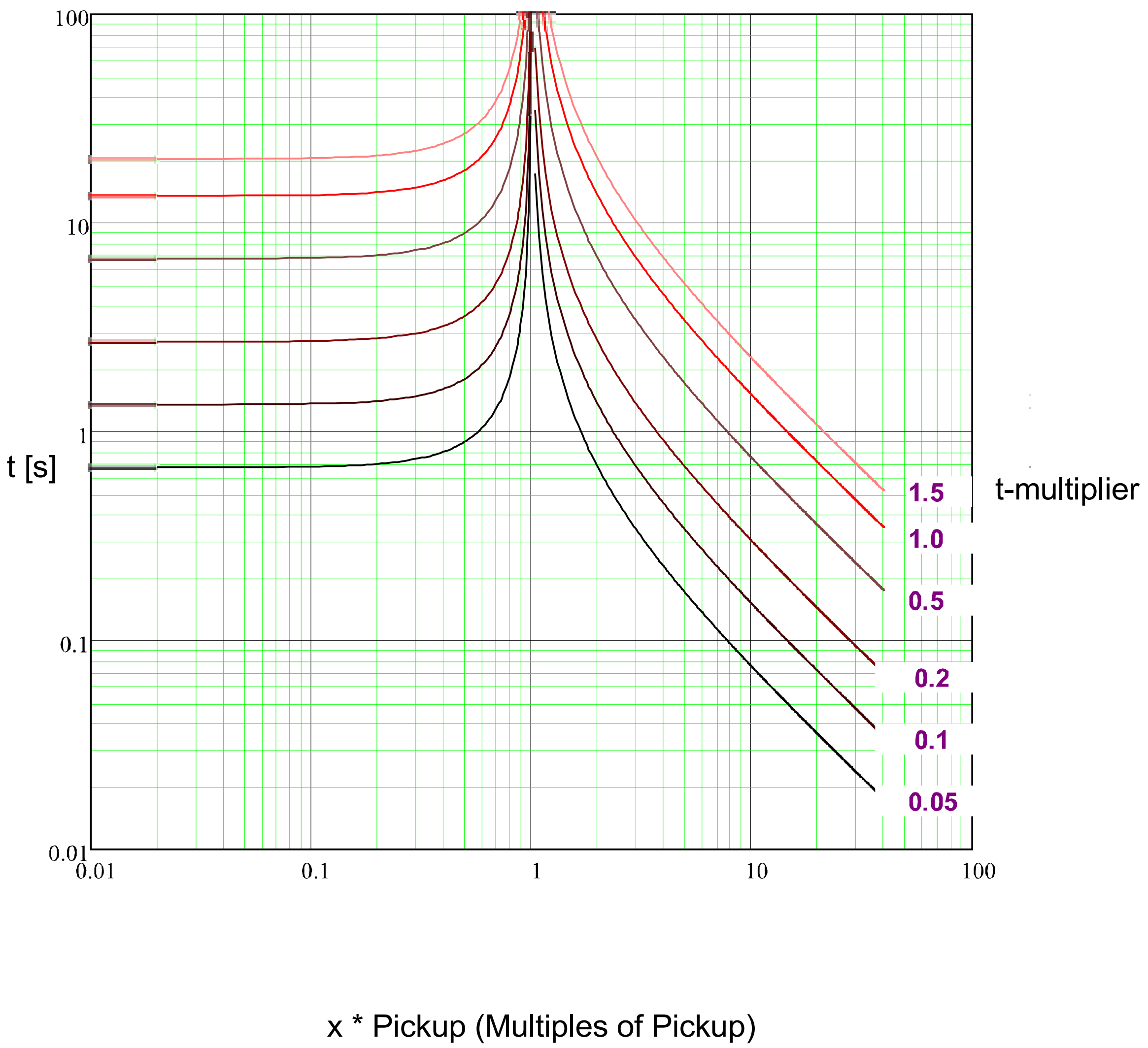
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{13.5}{\left(\frac{I}{Pickup}\right) - 1} \text{*t-multiplier [s]}$$



IEC LINV

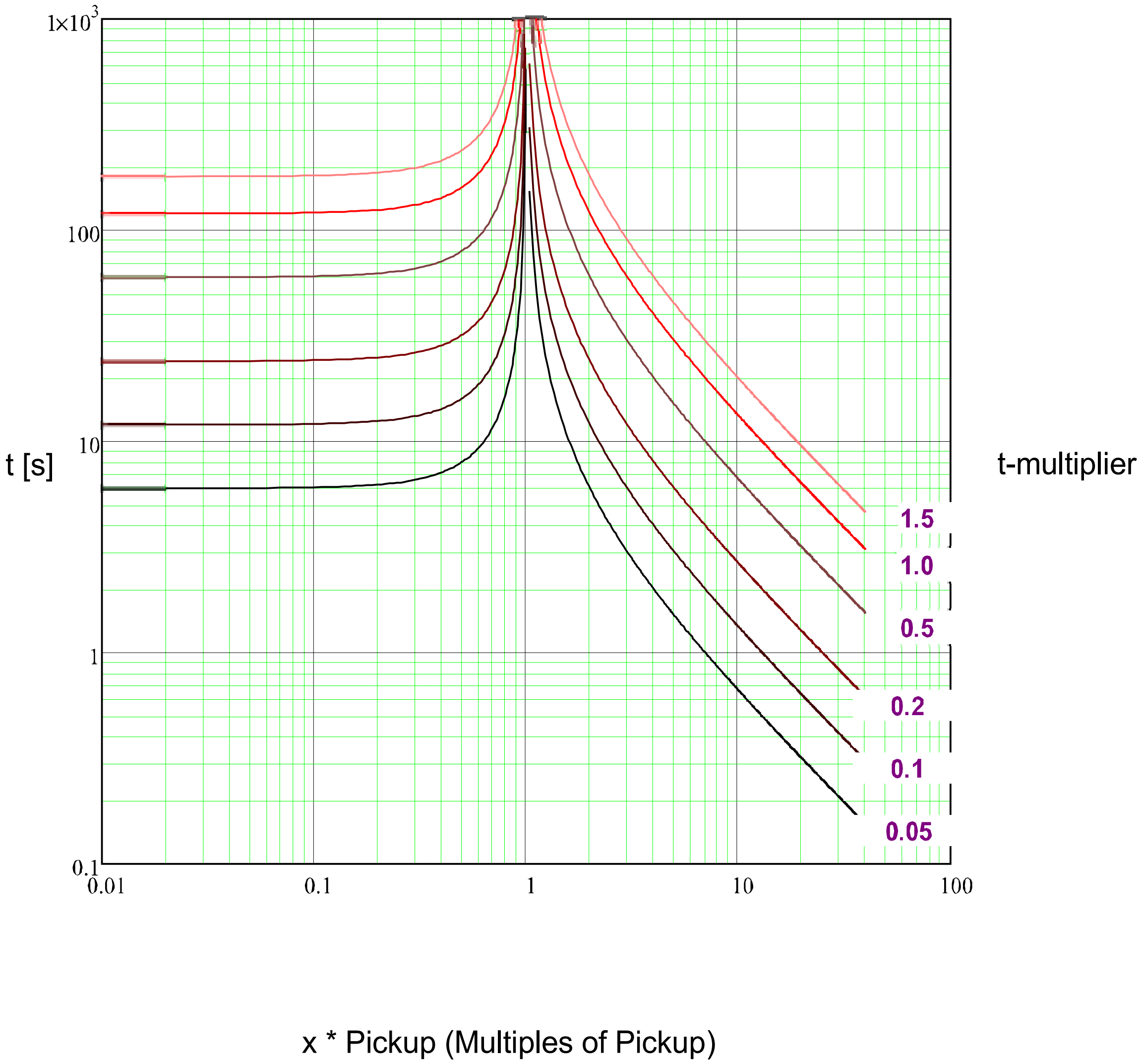
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{120}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{120}{\left(\frac{I}{Pickup}\right) - 1} \text{*t-multiplier [s]}$$



IEC EINV

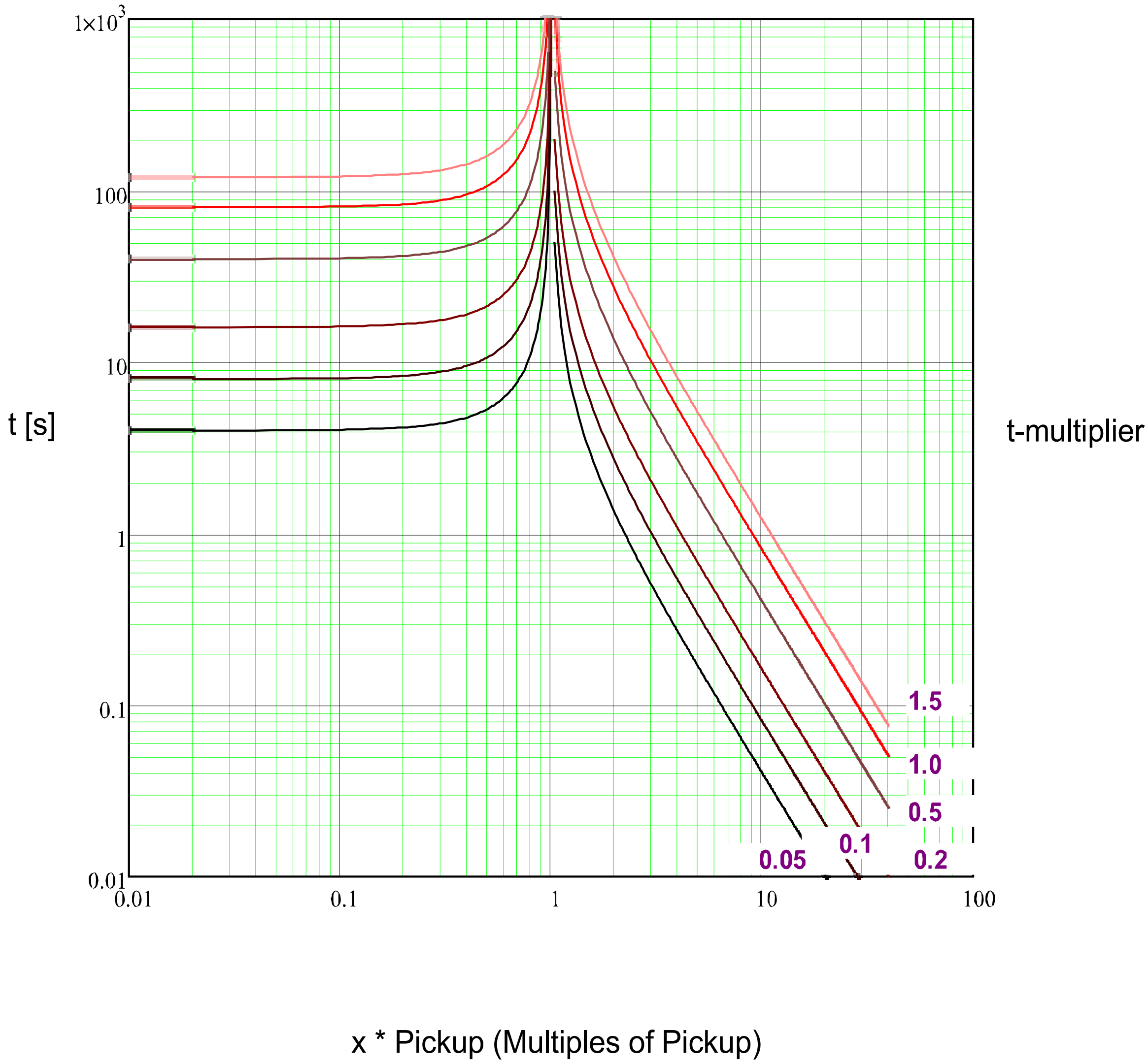
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{80}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{80}{\left(\frac{I}{Pickup}\right)^2 - 1} \text{*t-multiplier [s]}$$



ANSI MINV

Notice!

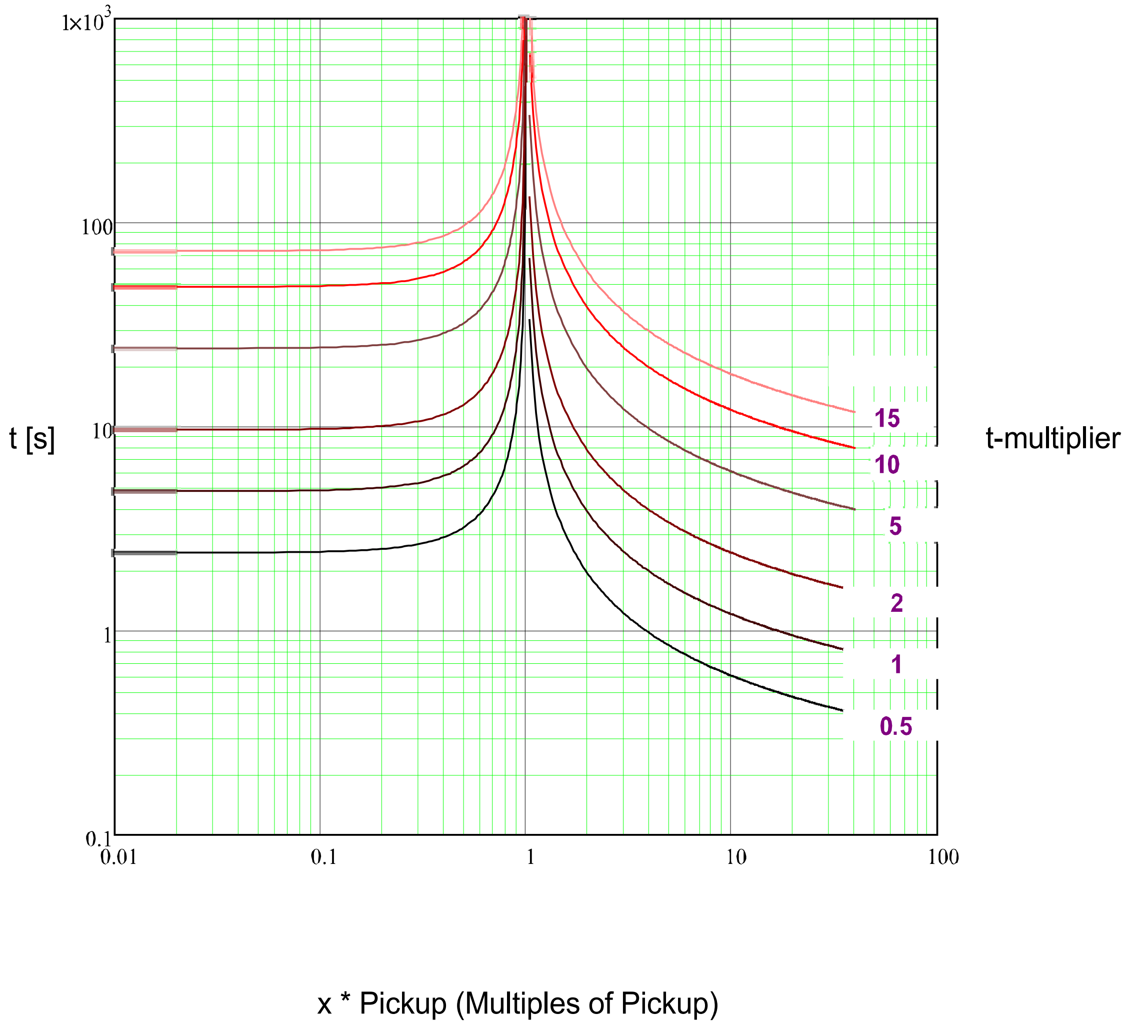
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{I}{Pickup}\right)^{2} - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{I}{Pickup}\right)^{0.02} - 1} + 0.1140 \right) \text{*t-multiplier [s]}$$



ANSI VINV

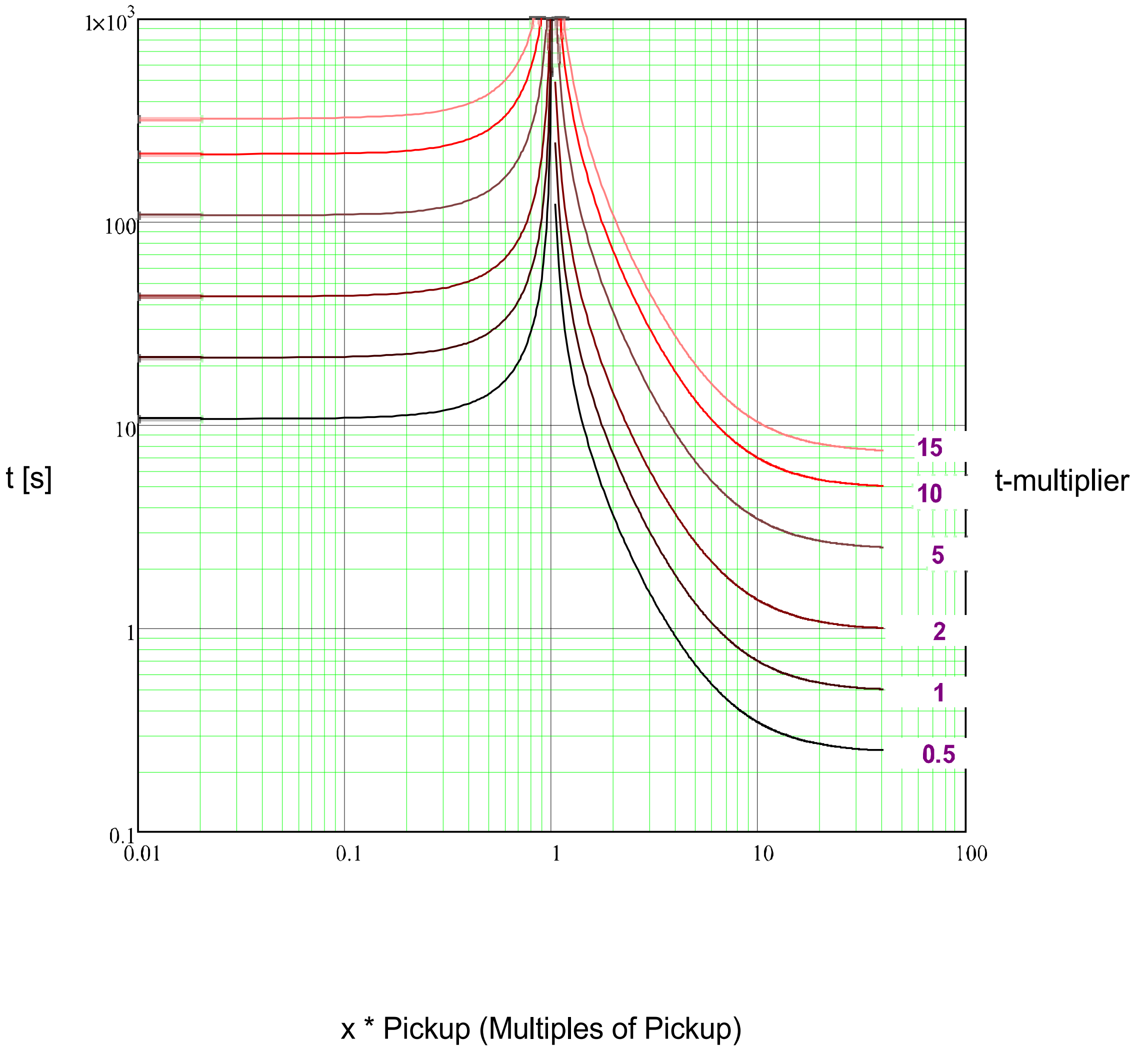
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{I}{Pickup}\right)^2 - 1} + 0.491 \right) \text{*t-multiplier [s]}$$



ANSI EINV

Notice!

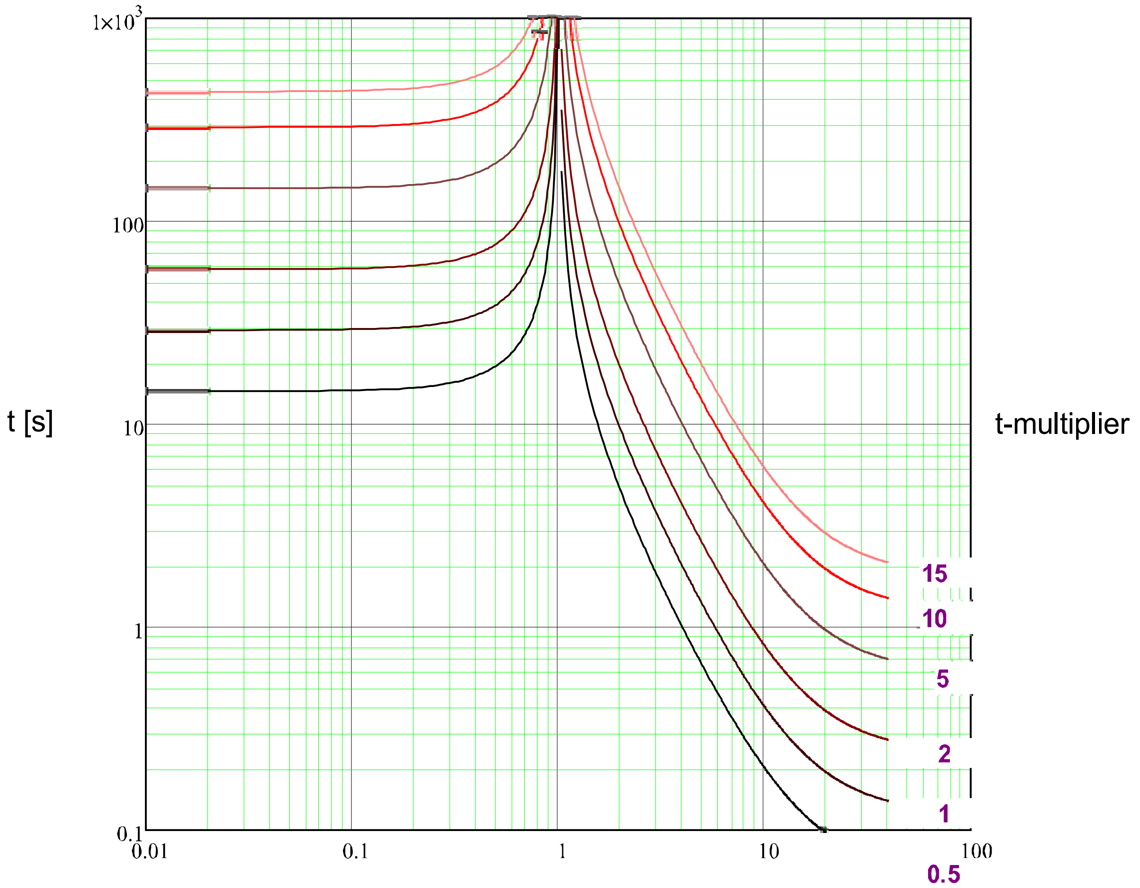
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{I}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{I}{Pickup}\right)^2 - 1} + 0.1217 \right) \text{*t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

Therm Flat

Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

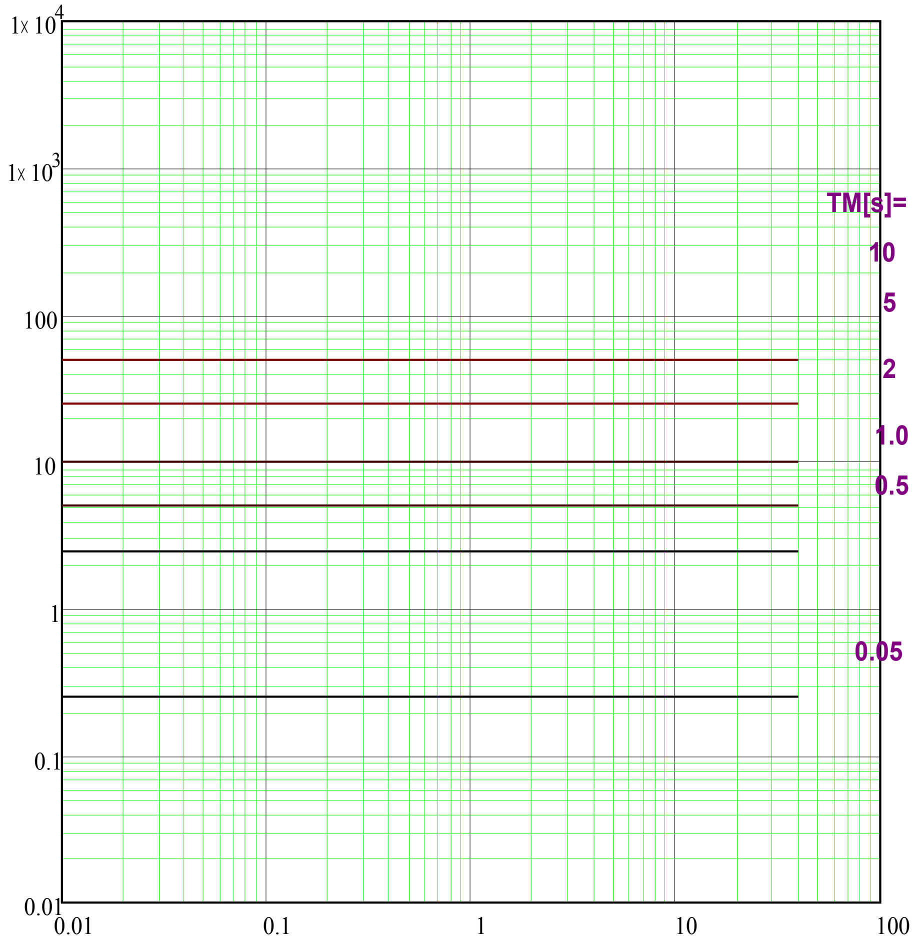
Reset

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| *\text{t-multiplier [s]}$$

Trip

$$t = \frac{5*1^2}{\left(\frac{I}{In}\right)^0} *\text{t-multiplier [s]}$$

$$t = 45 *\text{t-multiplier [s]}$$



x * In (Multiples of the Nominal Current)

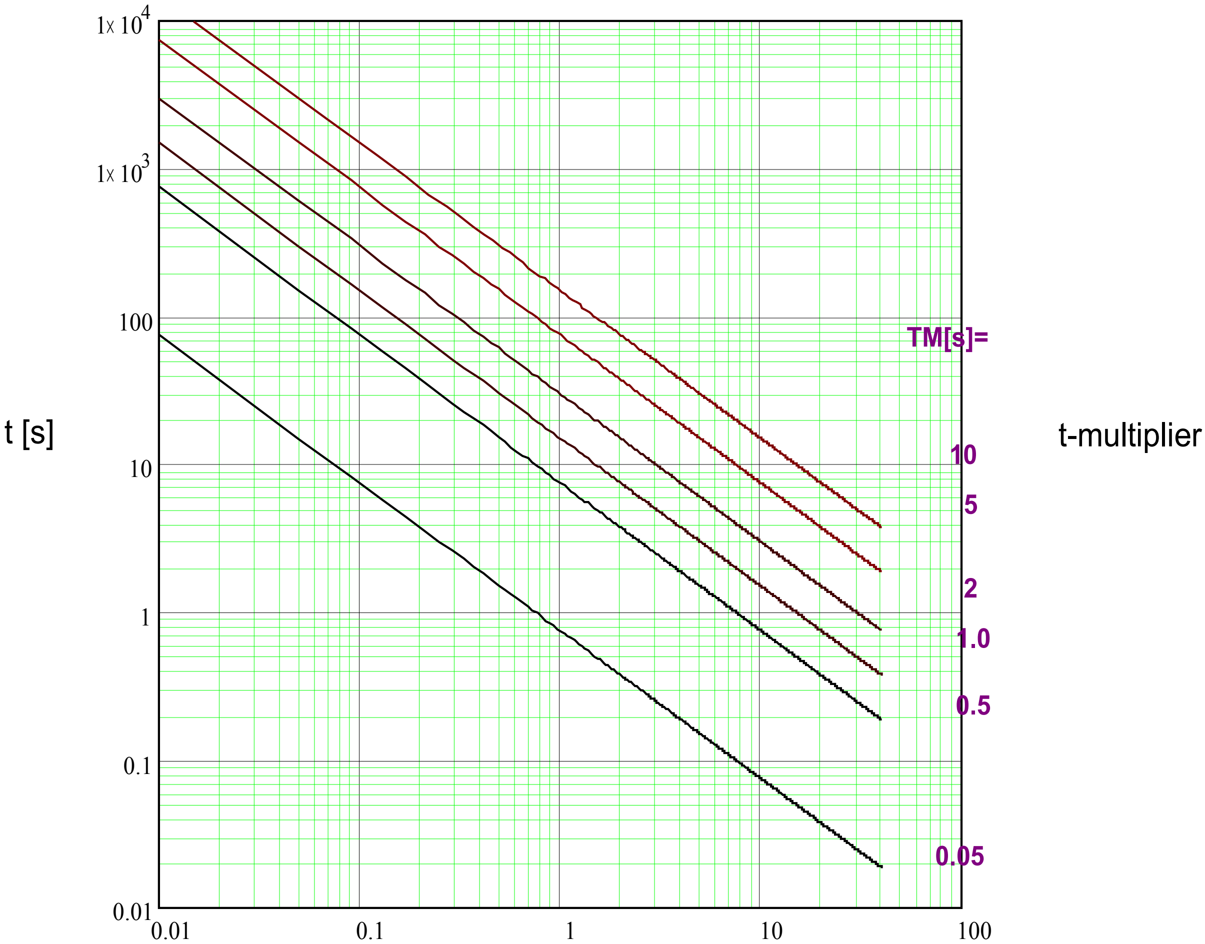
IT

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset **Trip**

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| \text{*t-multiplier [s]} \qquad t = \frac{5*3^1}{\left(\frac{I}{In}\right)^1} \text{*t-multiplier [s]}$$



x * In (Multiples of the Nominal Current)

I2T

Notice!

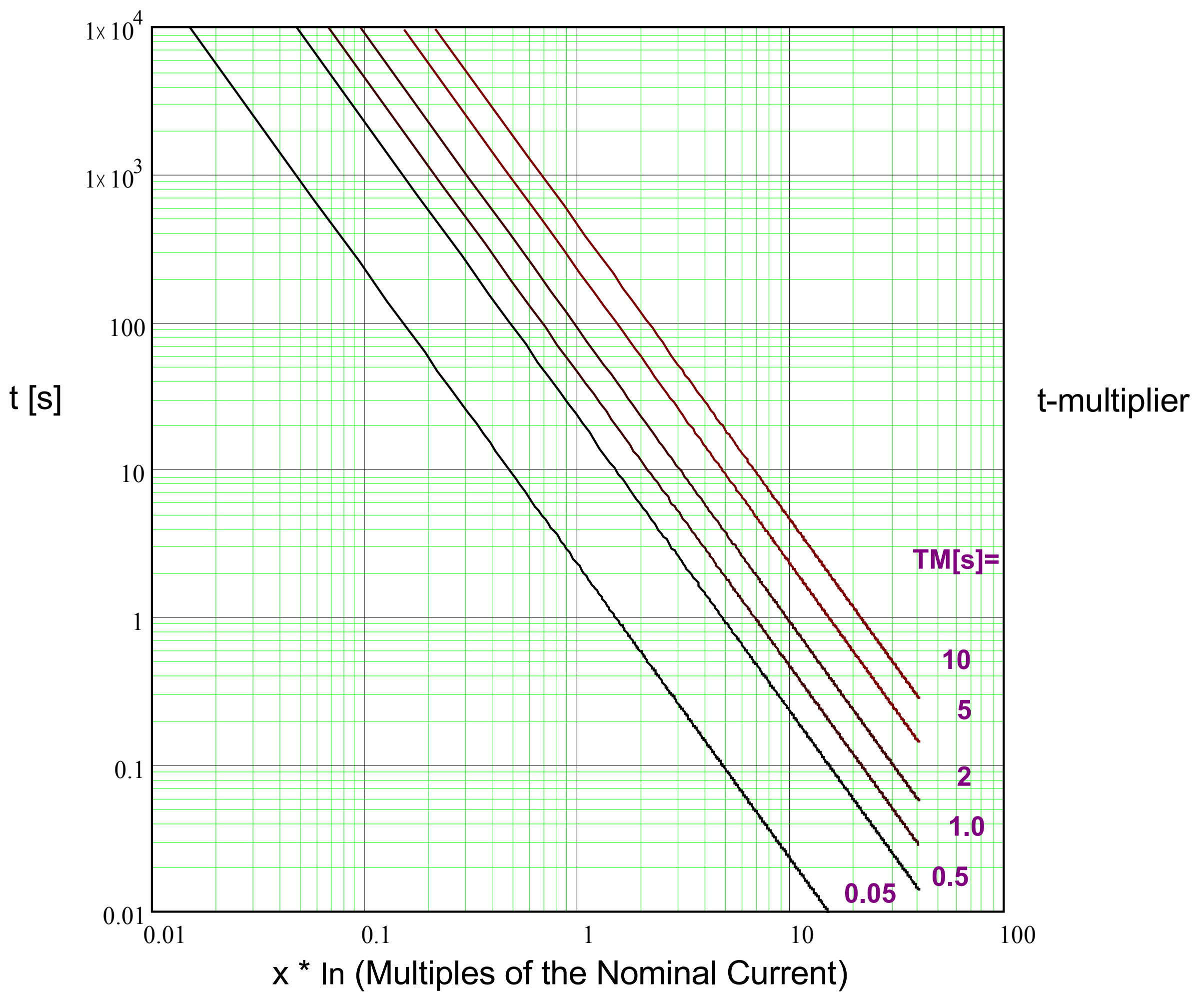
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{5*3^2}{\left(\frac{I}{In}\right)^2} \text{*t-multiplier [s]}$$



I4T

Notice!

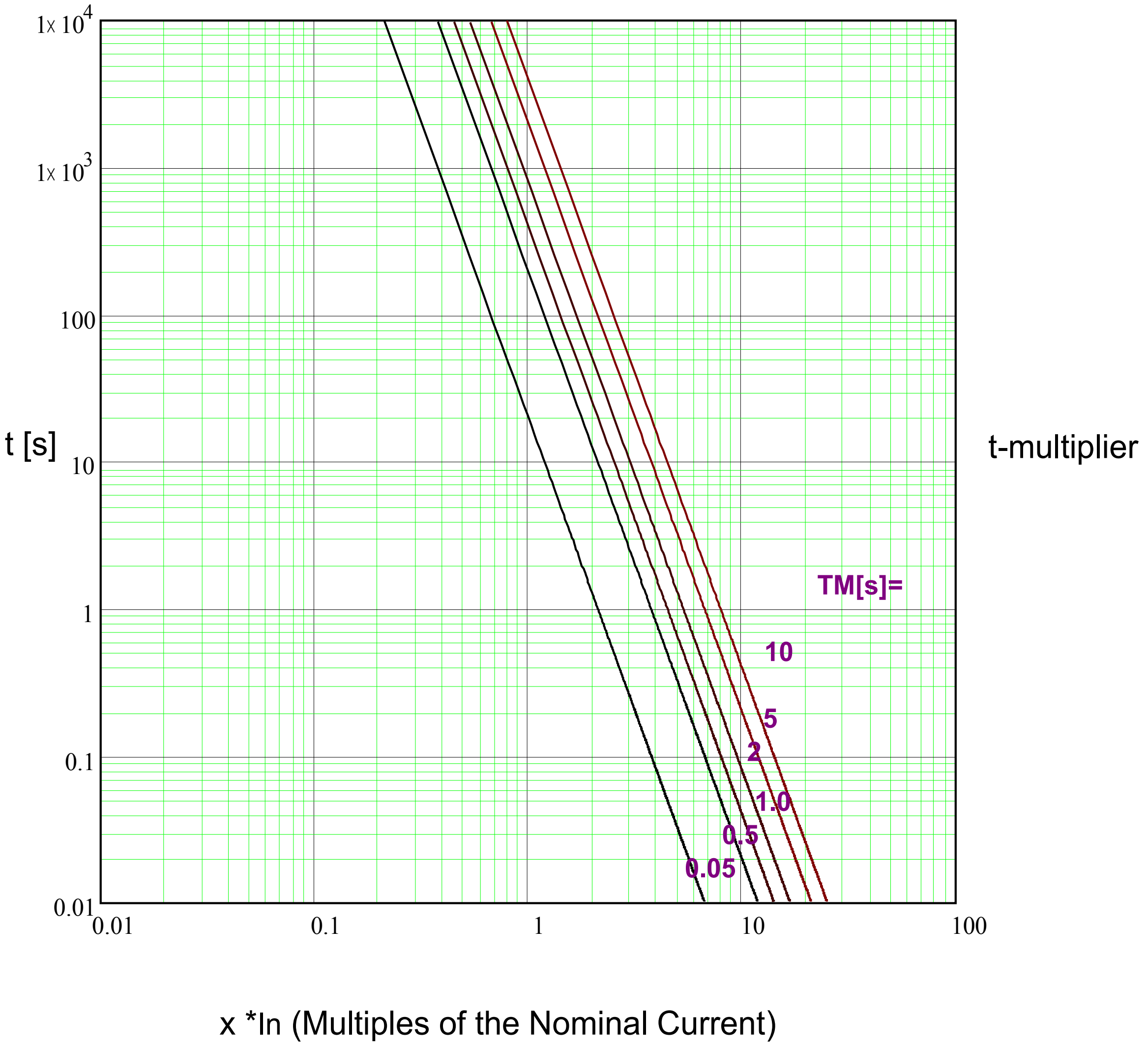
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{5*3^4}{\left(\frac{I}{In}\right)^4} \text{*t-multiplier [s]}$$



Instantaneous Current Curves (Ground Current Calculated)

The following characteristics is available:

- DEFT (definite time).

Explanation:

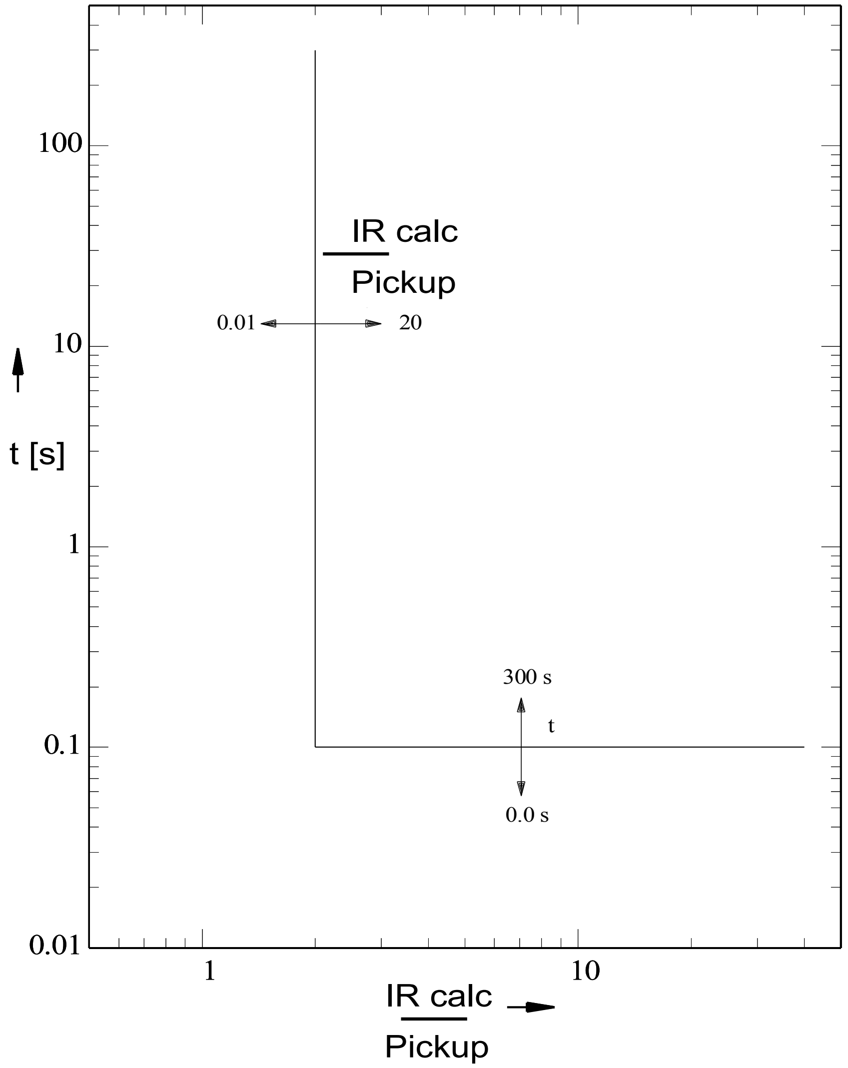
t = Tripping delay

IG = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents; but this is only possible if the current transformers are Wye-connected.

DEFT



Instantaneous Current Curves (Ground Current Measured)

The following characteristics is available:

- DEFT (definite time).

Explanation:

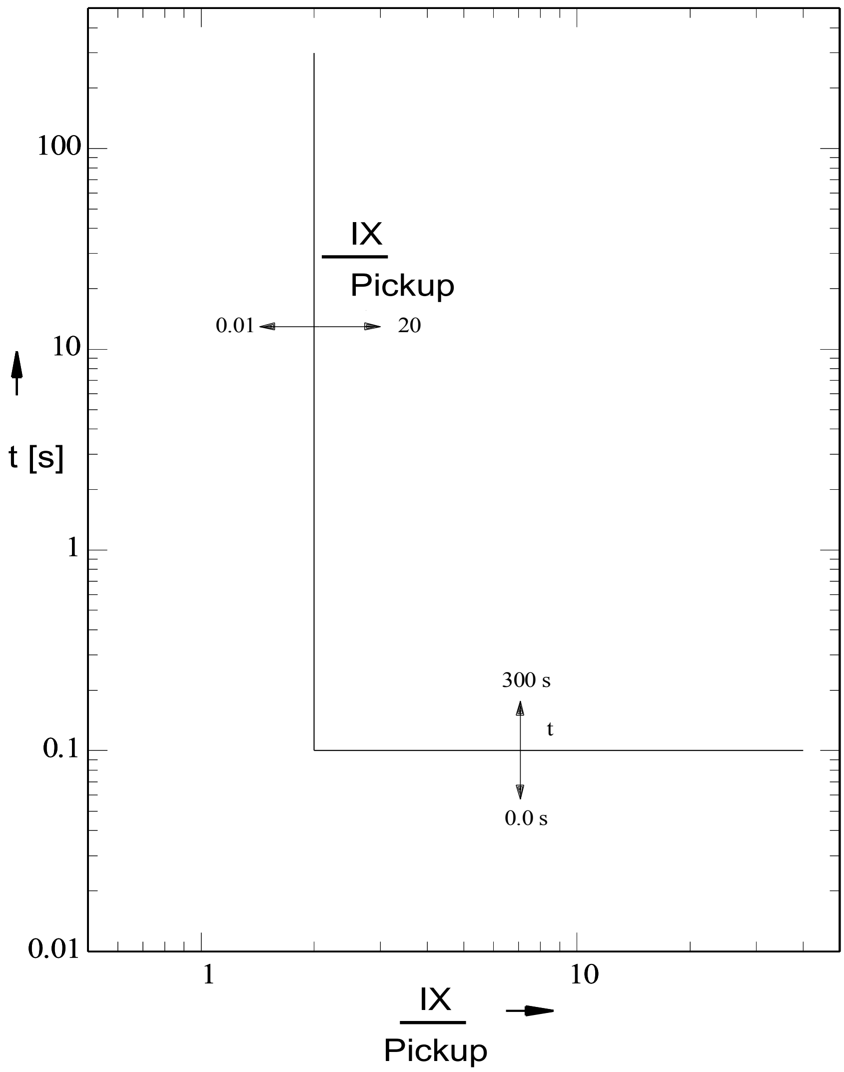
t = Tripping delay

IX = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents; but this is only possible if the current transformers are Wye-connected.

DEFT



Time Current Curves (Gound Current)

The following characteristics are available:

- NINV (IEC/XInv);
- VINV (IEC/XInv);
- LINV (IEC/XInv);
- EINV (IEC/XInv);
- MINV (ANSI/XInv);
- VINV (ANSI/XInv);
- EINV (ANSI/XInv);
- Thermal Flat;
- Therm Flat IT;
- Therm Flat I2T; and
- Therm Flat I4T.

Explanation:

t = Tripping delay

t-multiplier = Time multiplier/tripping characteristic factor

IG = Fault current

Pickup = If the pickup value is exceeded, the module/element starts to time out to trip.

The ground current can be measured either directly via a zero sequence transformer or detected by a residual connection. The ground current can alternatively be calculated from the phase currents; but this is only possible if the current transformers are Wye-connected.

IEC NINV

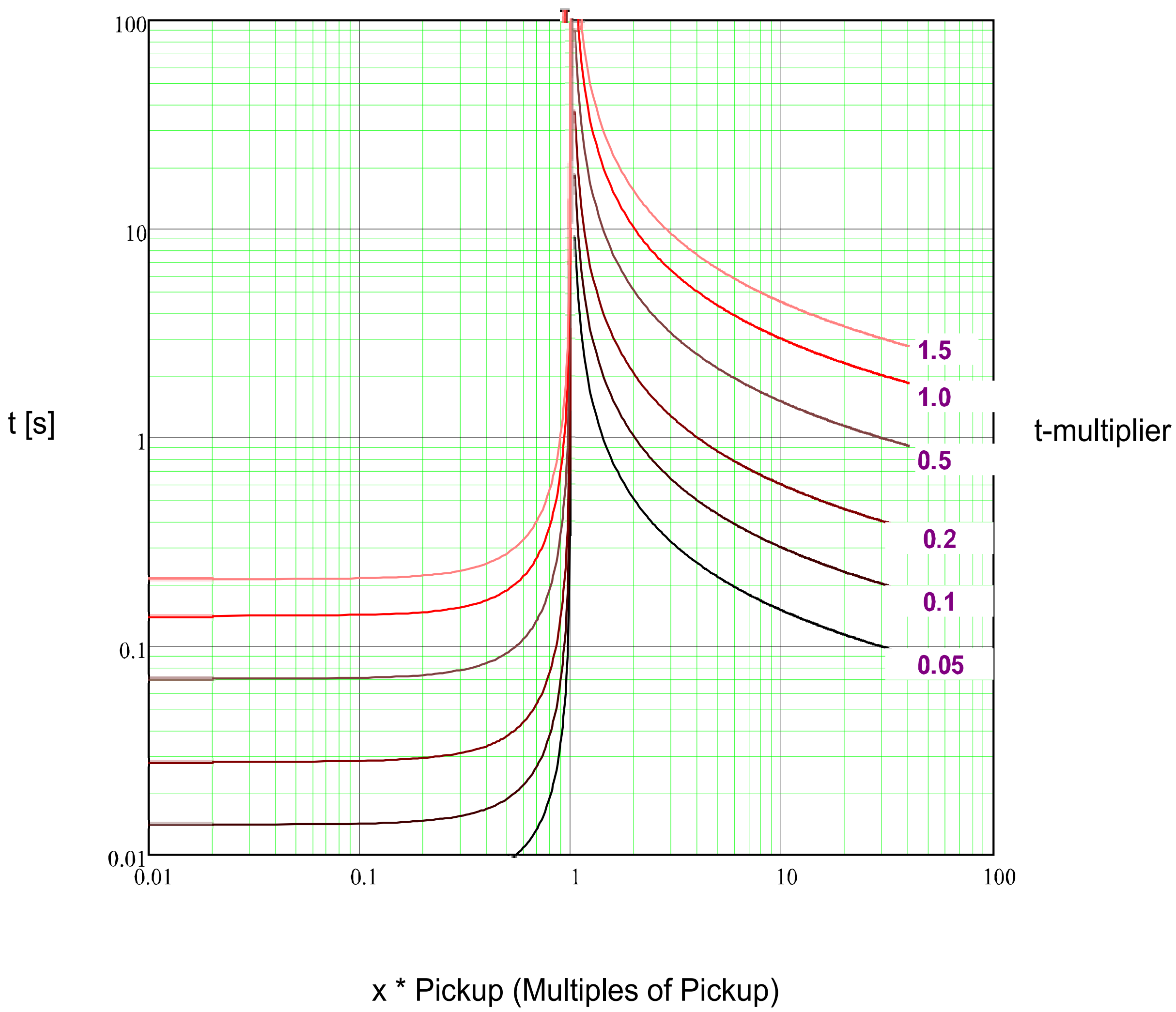
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{IG}{Pickup}\right)^{2} - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{0.14}{\left(\frac{IG}{Pickup}\right)^{0.02} - 1} \text{*t-multiplier [s]}$$



IEC VINV

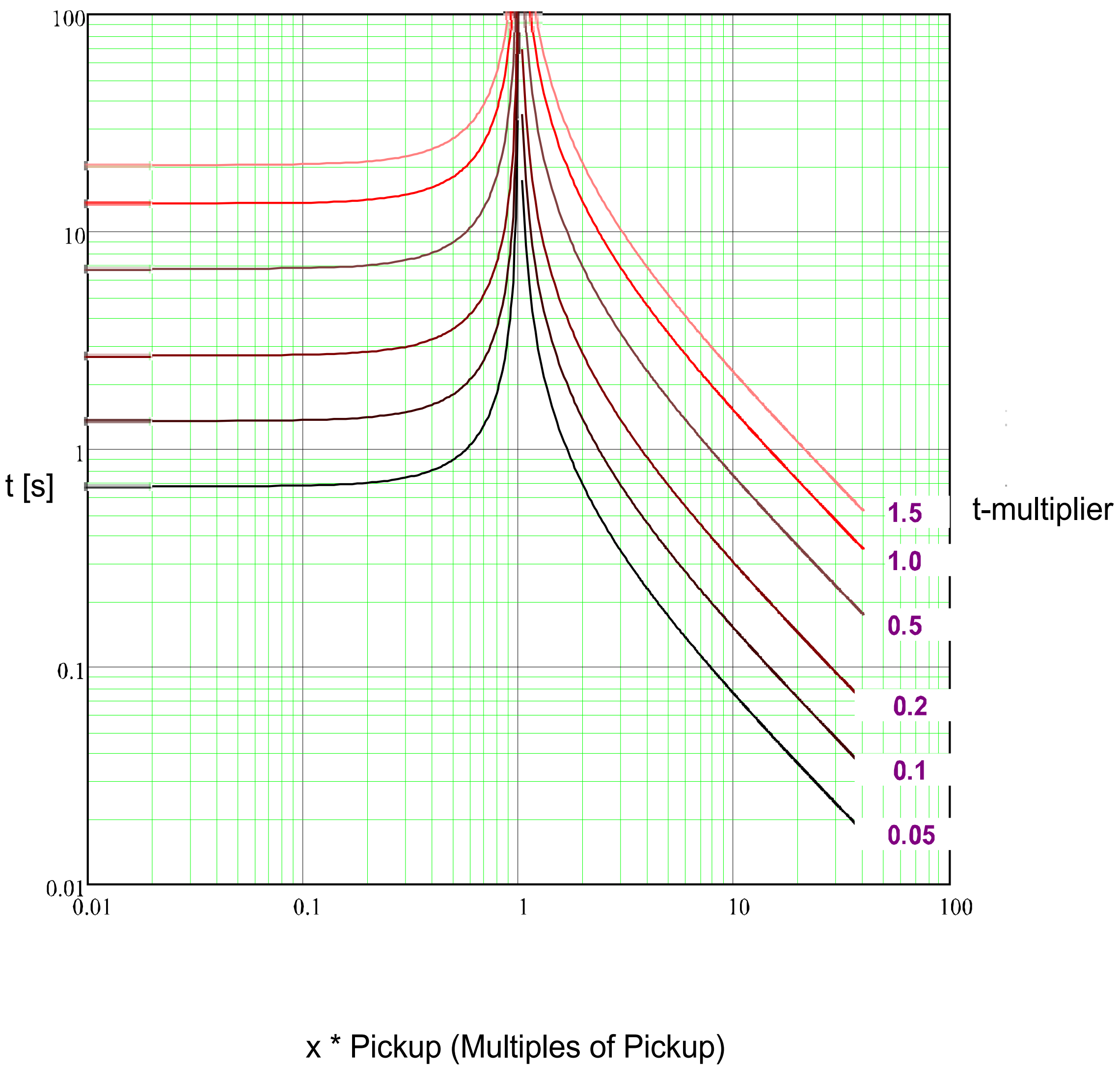
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{13.5}{\left(\frac{IG}{Pickup}\right) - 1} \text{*t-multiplier [s]}$$



IEC LINV

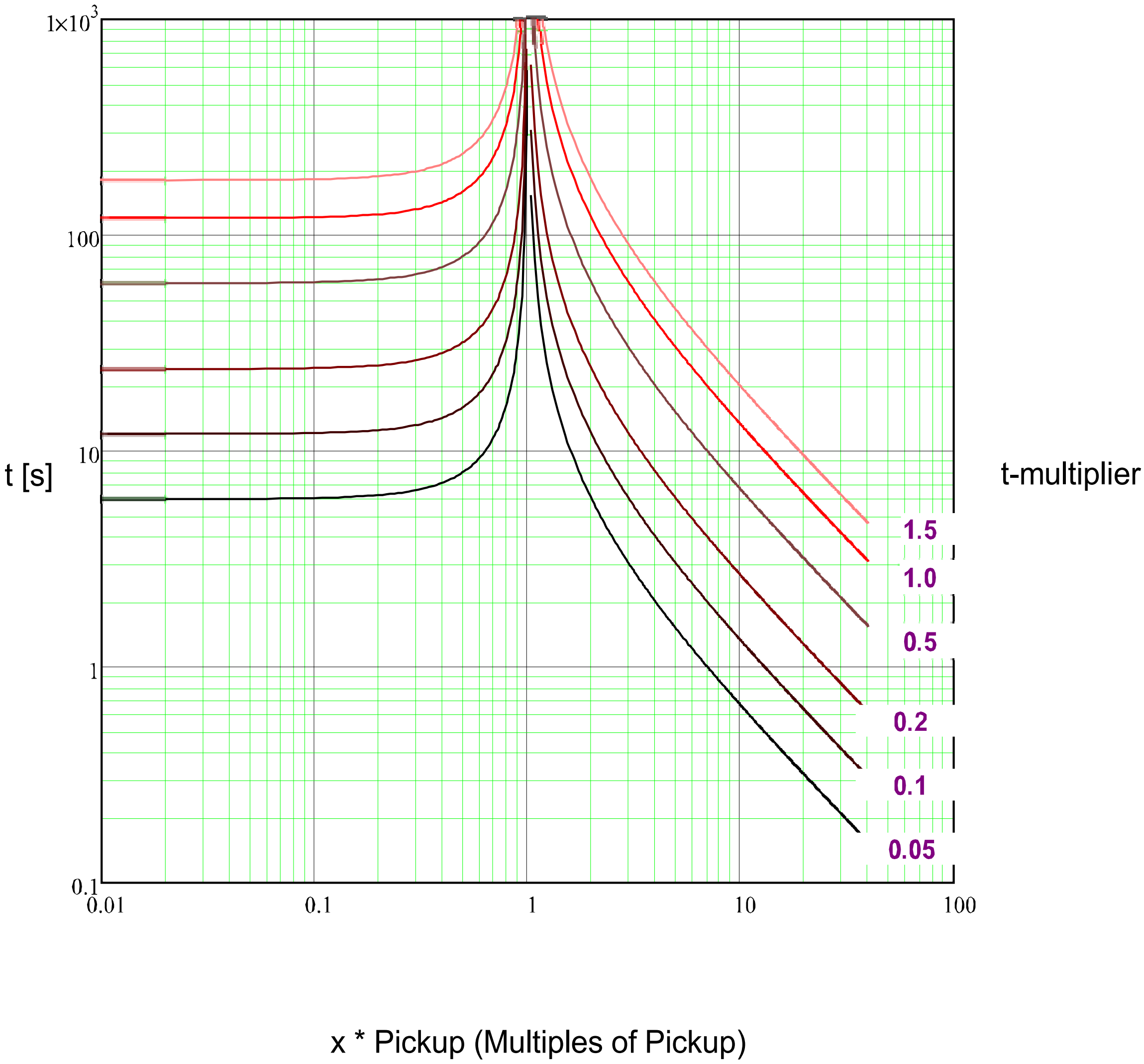
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{120}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{120}{\left(\frac{IG}{Pickup}\right) - 1} \text{*t-multiplier [s]}$$



IEC EINV

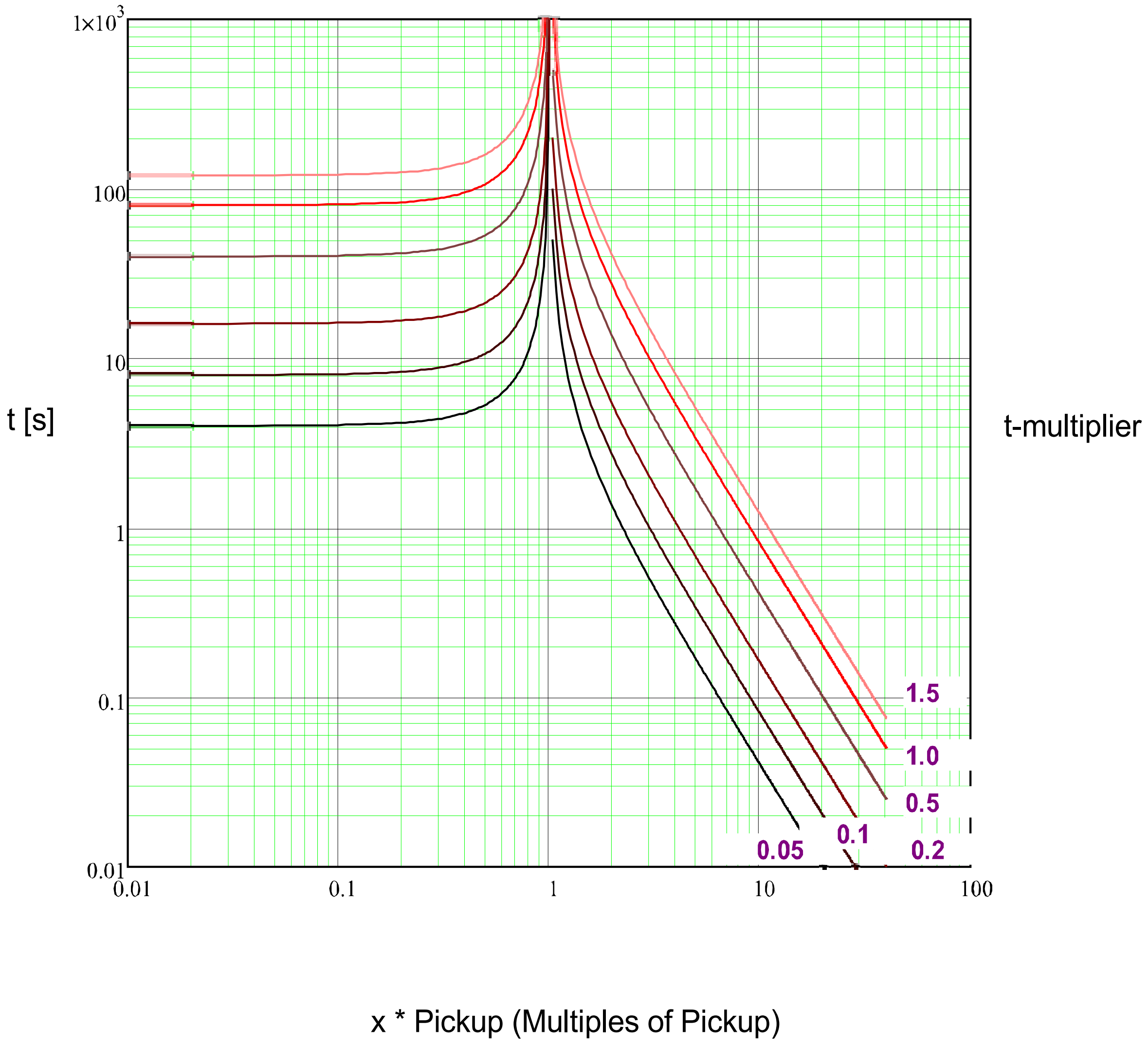
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{80}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{80}{\left(\frac{IG}{Pickup}\right)^2 - 1} \text{*t-multiplier [s]}$$



ANSI MINV

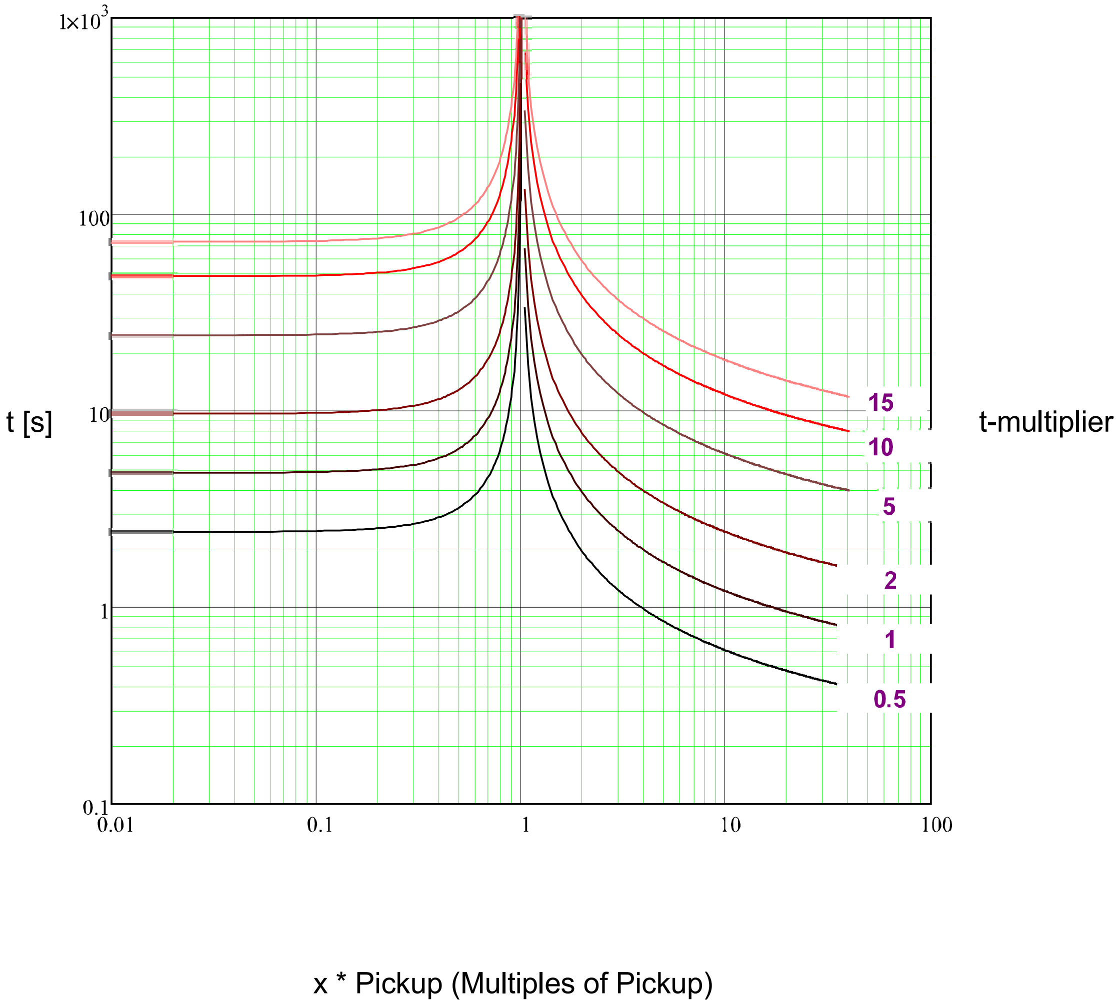
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{IG}{Pickup}\right)^{2} - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{IG}{Pickup}\right)^{0.02} - 1} + 0.1140 \right) \text{*t-multiplier [s]}$$



ANSI VINV

Notice!

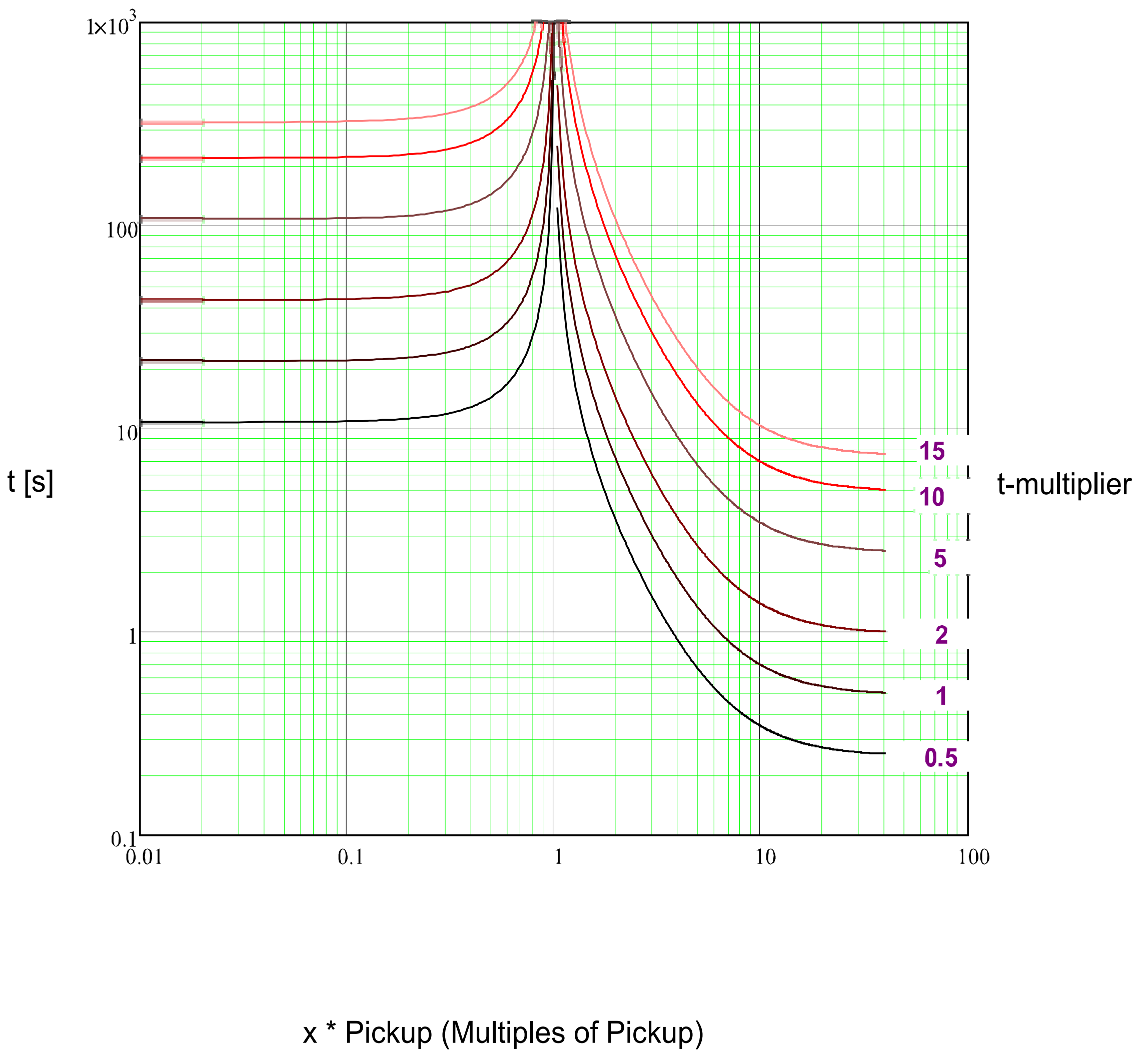
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{IG}{Pickup}\right)^2 - 1} + 0.491 \right) \text{*t-multiplier [s]}$$



ANSI EINV

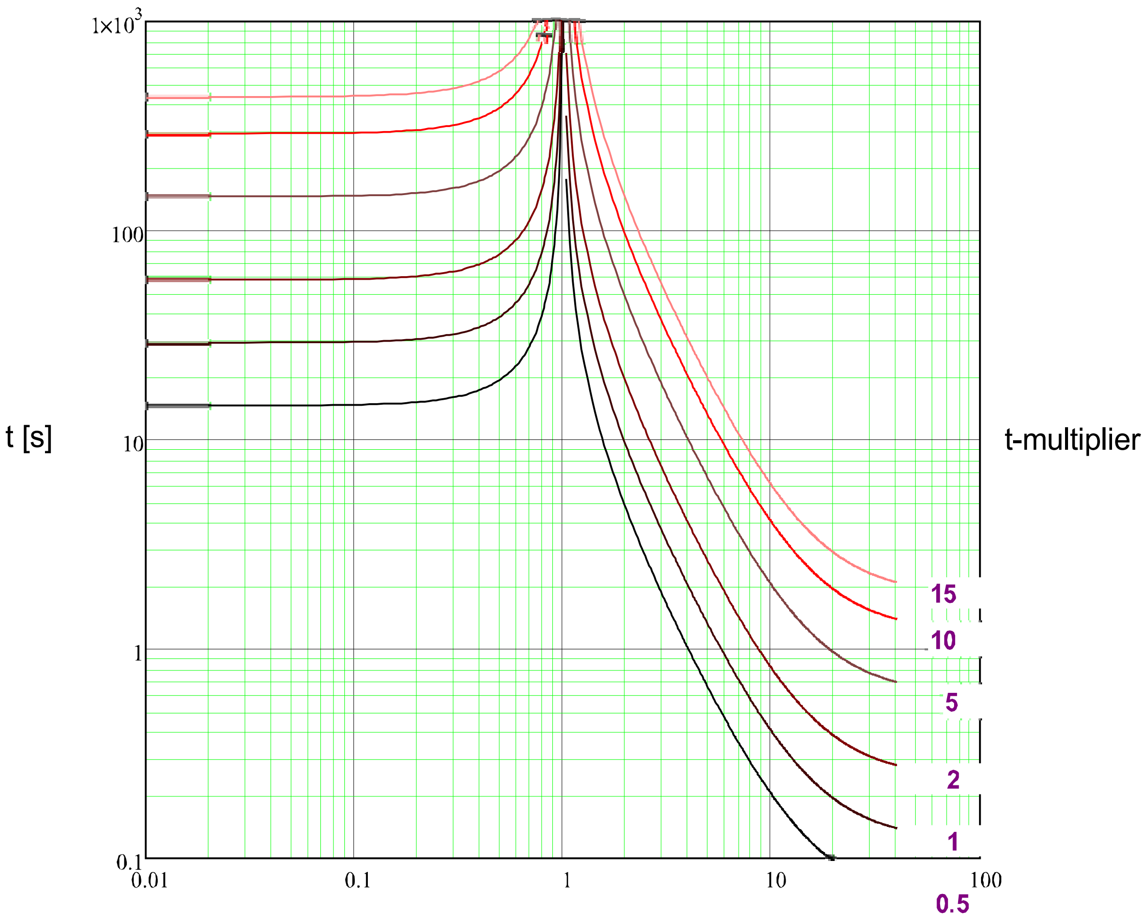
Notice!
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{IG}{Pickup}\right)^2 - 1} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{IG}{Pickup}\right)^2 - 1} + 0.1217 \right) \text{*t-multiplier [s]}$$



x * Pickup (Multiples of Pickup)

Therm Flat

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

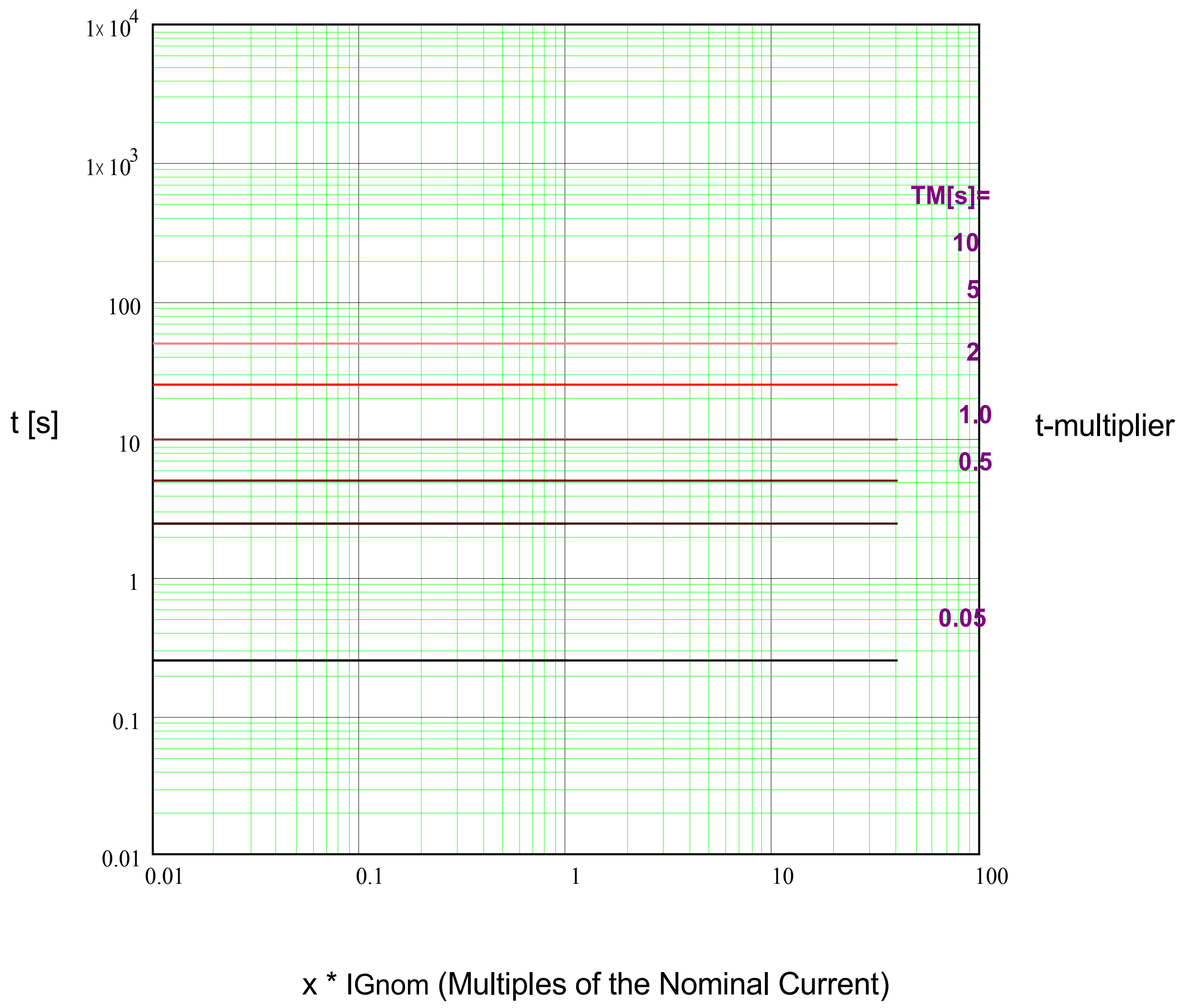
Reset

$$t = \left| \frac{5 * 1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| \text{*t-multiplier [s]}$$

Trip

$$t = \frac{5}{\left(\frac{IG}{IGnom}\right)^0} \text{*t-multiplier [s]}$$

$$t = 5 \text{ *t-multiplier [s]}$$



IT

Notice!

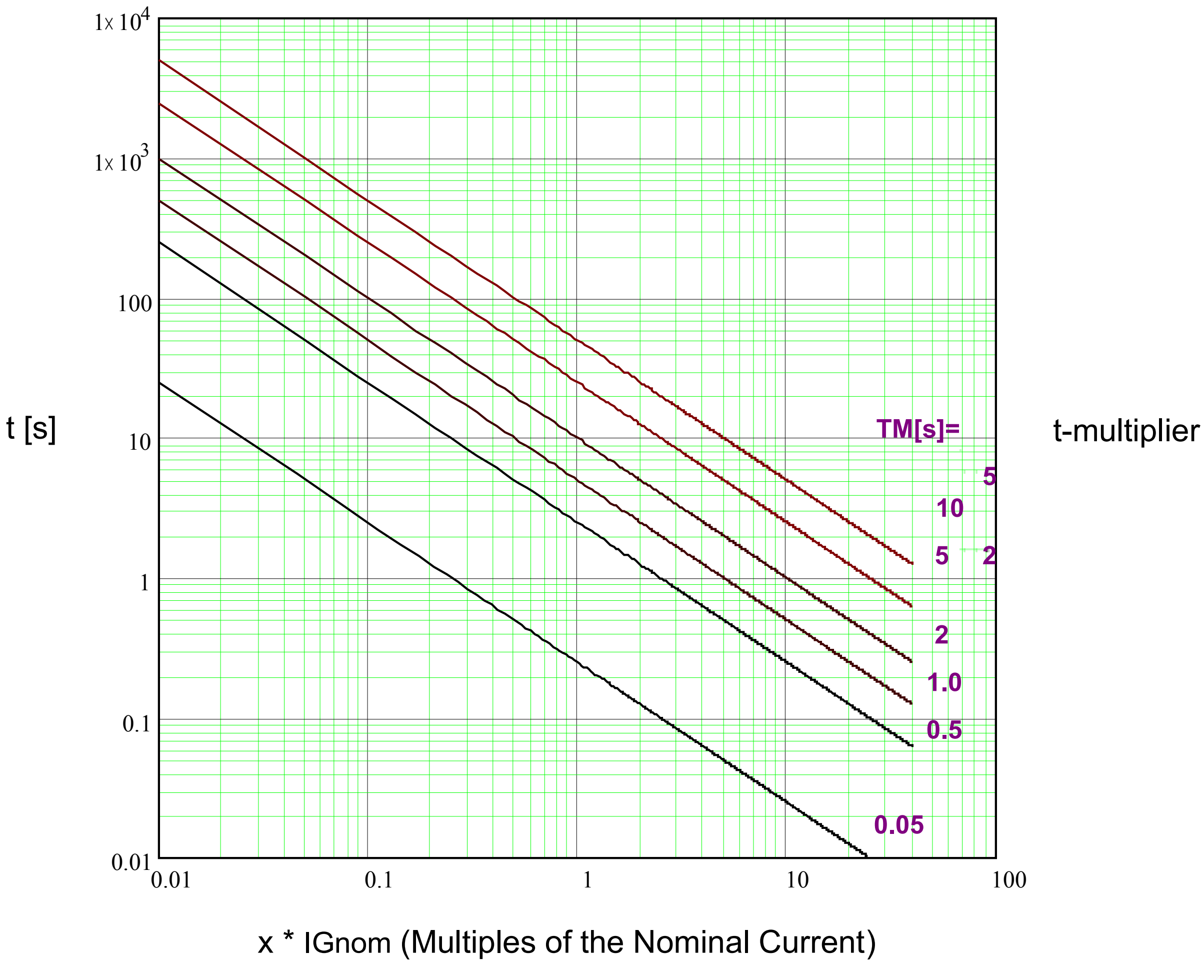
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5*1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| *\text{t-multiplier [s]}$$

Trip

$$t = \frac{5*1^1}{\left(\frac{IG}{IGnom}\right)^1} *\text{t-multiplier [s]}$$



I2T

Notice!

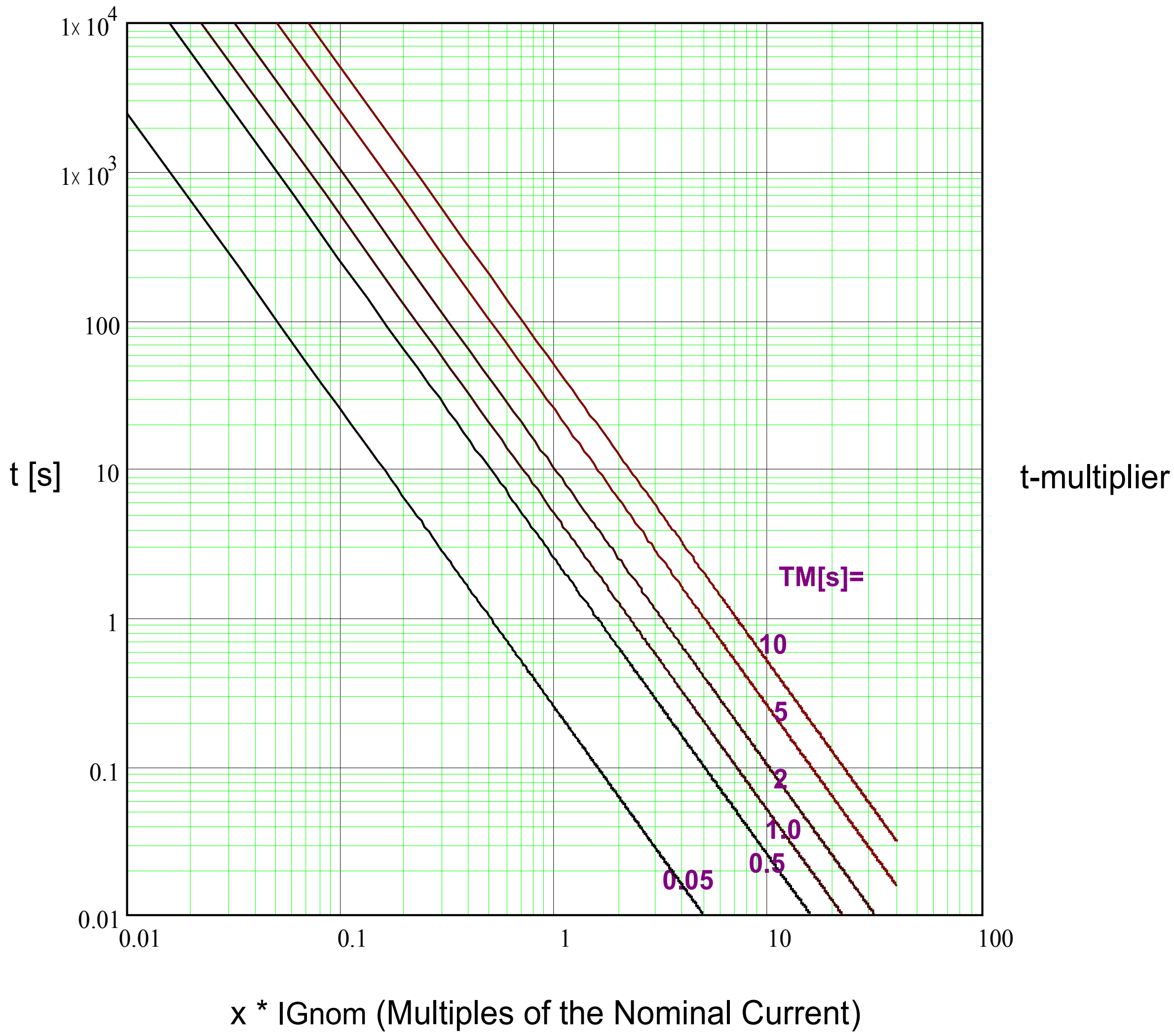
Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset

$$t = \left| \frac{5*1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| * \text{t-multiplier [s]}$$

Trip

$$t = \frac{5*1^2}{\left(\frac{IG}{IGnom}\right)^2} * \text{t-multiplier [s]}$$

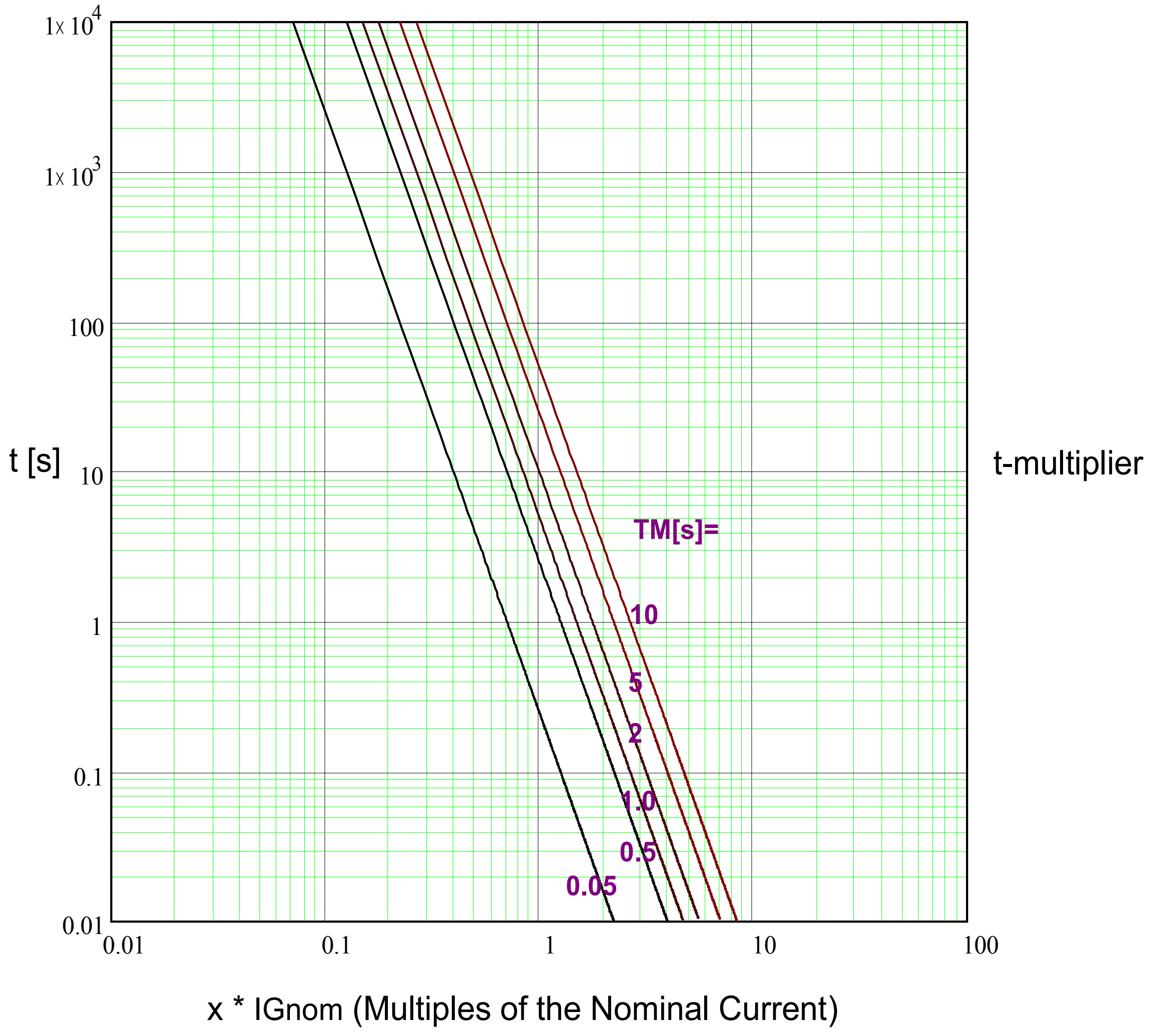


I4T

Notice!

Various Reset Modes are available. Resetting via characteristic, delayed, and instantaneous.

Reset	Trip
$t = \left\| \frac{5*1^2}{\left(\frac{IG}{IGnom}\right)^0} \right\|$ *t-multiplier [s]	$t = \frac{5*1^4}{\left(\frac{IG}{IGnom}\right)^4}$ *t-multiplier [s]



Instruction Leaflet **IM02602006E**

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EDR-4000

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